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FEATURES OF EXPORT TRADE.

The statistics for November show a further marked gain in values of electrical export trade and strengthen the note of confidence heard in all discussions as to the future of the market. It appears that during November the exports of heavy electrical machinery, which have been falling seriously behind previous months and other years, came up with a sharp advance, and were valued at $470,687, as compared with $295,915 in the corresponding month of 1908. The gains were chiefly in exports to Brazil, Japan, South Africa and the United Kingdom. In electrical instruments and smaller apparatus the previous steady gains were maintained and the total reached a sum of $584,210, as compared with $463,588. The two items added together amount to $1,054,897, as compared with $759,503, a gain of nearly $250,000, and of about 30 per cent. There is here every evidence of revival of foreign interest and purchasing power. The total of all electrical exports for the 11 months ending November, 1909, was $11,884,433, as compared with $11,414,555 in the same period of 1908, or a gain of $469,878. With tendencies as they now are, there should be a further addition to this gain in the twelfth month, bringing it up to $500,000, or about 5 per cent. It will be noted that the gains have grown sharply as the year advanced, all indicating that 1910 may be expected to equal, if not excel, any conditions of the past.

In reviewing these figures, one or two points should not be overlooked. The electrical export trade should really be credited with many items it does not include simply for the reason that they are not electrical manufactures. Thus, within the past fortnight 750 of the large "New York Edison" arc-light posts have been ordered for Rio de Janeiro, as a first shipment. These are, of course, credited to iron export, but they are virtually just as much a part of the electrical industry as the dynamos that will deliver electrical energy to the lamps upon them. On the other hand, values are necessarily somewhat larger on account of the higher price of raw materials entering into the goods. Rubber, for example, averaged 97.5 cents per pound last November, as compared with 66.4 cents in the same month of 1908 and 48.7 cents in April, 1908, so that it may be said to have doubled in average price in the foreign markets in about 18 months. Such things swell values, but do not by any means add to the profitableness of manufacture or of export trade. In like manner, there is no doubt that the high values of electrical production in 1906-7 were in quite large measure due to copper somewhere up around 25 cents a pound.

A point to emphasize in the development of electrical export trade is the fact that it depends on incessant variation and the pushing of novelties. The trade is subject to a constant check in the fact that after an article or machine has been shipped abroad for some time, it is found desirable to transfer its production to the chief foreign countries of consumption, if Euro-

pean, to save freight and duties, and to protect patents. This process is seen in active operation, and its influence is felt, when such a laudable proposition is brought forward as the American Exposition to be held at Berlin this summer under the direct personal patronage and encouragement of Emperor William and his brother, Prince Henry. The principal electrical manufacturers of this country have handed over the production of their goods for Germany to local concerns there, so that the only way to show such "American" apparatus would be to put in line that which is actually made within the empire. In a way, therefore, this country is debarred from getting credit in foreign eyes for that which is distinctively American, and, correspondingly, just so much export trade is cut off. We see parallel results in the removal of silk, cotton, pottery works, etc., to this country by European firms otherwise held off by the tariff. The situation is an interesting one, and the real facts as to international trade become complicated and confused. Nevertheless, our contention remains sound that there is a large market still open abroad for all kinds of novelties and specialties, and that it pays to seek such markets out. Moreover, we have entrance to and ready acceptance in some of the best markets that do not produce electrical apparatus and must buy abroad.

ELECTRIC VEHICLE OPERATION CHEAPER THAN USE OF HORSES.

The thanks of all interested in electrical and automobile pursuits is due to the Commonwealth Edison Company of Chicago for making the elaborate research into the comparative costs of operation of electrical and horse-drawn delivery wagons, which is summarized in statistical form in an article given in this issue, entitled "Central Station Experience with Electric Vehicles." The information thus made public is extremely valuable and will be welcomed by all who are making a study of the possibilities of the electric vehicle. The figures given are complete and elaborate, and the reader is referred to them for detailed information, showing how the conclusions are reached. The investigation boils down to this: that in the case of the Commonwealth Edison Company, where a large number of electric power wagons and horse rigs has been employed side by side, the actual cost of operating the electric vehicles is shown to be sensibly less than that of operating the horse-drawn vehicle. The comparison has been made very carefully and thoroughly and in all fairness, and the result is certainly a triumph for the electric commercial wagon.

Furthermore, the cost of operating electric vehicles is decreasing rather than increasing, whereas the reverse is true in the case of the horse-drawn rigs. The decrease in the case of the electric type is due to improved construction, greater care in operation and decreasing cost of electricity. The increase in the cost of operating the horse wagons is largely to be ascribed to the constantly rising price of feed. The electric vehicle has the advantage also in that it presents a better appearance and makes for a cleaner, more sanitary city. In the matter of maintenance of pavements, also, the electric vehicle possesses a decided superiority. Weight for weight, the electric wagon will cause less deterioration of the pavement than the horse wagon, to say nothing of a substantial reduction in the cost of street cleaning where the electrics are employed. Again, the greater ease of control and compactness of the electric vehicles tend to relieve the congestion on the streets of large cities. A still further consideration, in the case of electrical concerns, is the advertising given to the use of electricity by the increasing number of electric vehicles apparent to all who use the streets. For a long time it has been thought that the cost of electric vehicle operation was less than that of corresponding vehicles drawn by horses, but now the fact seems to be demonstrated beyond question. The statistical information now available, as a result of the tabulated records of the Commonwealth Edison Company, should give a decided impetus to the use of electric vehicles, particularly of the commercial type.

THE WIRELESS TELEPHONE.

The great advantage which the wire telephone would possess over the wire telegraph is not merely on account of no special technical training being required to interpret the communication through the medium of Morse code, but mainly that the tones of the speaker's voice would be reproduced in the distant receiver. The psychological effect of the voice reproduction is so powerful that mere telegraphic signaling is not in the same class with telephonic signaling. The telegraph is to the telephone as the marionette is to the living actor in dramatic production. The one is but a phantom, and the other a real presence. So, too, in wireless signaling, the range of transmission in wireless telegraphy is likely always to be greater than that in wireless telephony, and is at present much the greater; but wireless telegraphy, while it has a necessary part to play in public service, is in a class apart from wireless telephony. The former can only carry signals through space, the latter can carry personality and the force of mind. When a man uses the globe to telegraph over wirelessly, he subjects the circumambient ether to his will for enabling his ideas to be detected abroad. But when he telephones wirelessly, he extends his personal range of influence to the distance of his most remote hearer. In this sense, and to this degree, he owns that portion of the earth over which his voice is heard. The doctrine of collectivism and mutual ownership of the world has never received at the hands of the boldest communist so broad an interpretation as is spelled literally, and without reserve, by the term long-distance wireless telephony.

The article by Mr. John L. Hogan, Jr., in this number, points out the limitations in range and in availability of the wireless telephone of to-day as compared with the field of usefulness that lies before the apparatus when these limitations shall have been removed. We must, however, remember that wireless telegraphy is still very young, and that wireless telephony is but an offshoot from its youthful tree. It is futile to repine at the infertility of the immature fruit tree. It is hardly conceivable that so valuable and important a system as wireless telephony shall remain indefinitely without advance. As mentioned in the article, wireless telephony is carried on to-day by exciting the sending antenna into very rapid and sustained electric oscillations, of frequency far above the limit of audibility. The sending antenna is thus caused to radiate, as nearly as possible, an unbroken succession of high-frequency electro magnetic waves during the period of conversation. These waves, intercepted at the receiving antenna, are of themselves

incapable of producing audible sounds of any kind, much less vocal sounds; but by making the speaker's voice modify the amplitudes of the sending oscillations and emitted waves, in conformity with the lower frequency vocal tones, the high-frequency intercepted impulses at the receiver wax and wane at the lower vocal frequencies and set up corresponding vocal sounds in the receiver in conformity with the changes in amplitude. This is a very beautiful principle, and like the old principle of *lux a non lucendo,* suggests a corresponding *vox a non vocando,* or the winning of vocal tones from inaudible tones. Of course, the transmitter apparatus not only has to carry the oscillatory currents of sufficient strength to radiate out waves in all directions and yet affect the distant telephone, but must also be able to impress the required variations in amplitude upon these powerful oscillatory currents—a feat that calls either for a stentorian voice, or for a wonderful capability to regulate the flow of electric current and power. At present these conditions impose limitations upon the system, but means will doubtless be found to overcome these limitations, in degree if not entirely.

MOTOR LOADS.

Statistics regarding central-station operations must be carefully treated in order to produce valuable results, on account of the immense local variation of conditions of which no account can be taken in a statistical examination. Nevertheless, figures on the matter are instructive, and an article by Mr. Alton D. Adams, published elsewhere in this issue, takes up a brief analysis of the electric-motor business in a somewhat instructive fashion. A mere glance at the table shows the extremely undeveloped character of this class of business. The yearly income per inhabitant from motor service is a variable of the most extraordinary character. In the 16 cities selected by Mr. Adams for comparison, the annual income per inhabitant for motor service ranged from 20 cents to $1.46. The income per horse-power of motors installed in the two extreme cases was, singularly enough, not widely different, but the price per average kw-hour supplied in these instances varied greatly, the plant which showed the minimum earnings per inhabitant getting something over 8 cents per kw-hour, while the plant of the maximum earnings per inhabitant got but a shade over 2½ cents per kw-hour. In this department of electrical supply, as in practically every other, large earnings depend upon moderate prices, and it is very evident that there is a maximum figure obtainable for motor business, exceeding which has a disastrous effect on the total volume of business and necessarily upon the profits obtained.

An inspection of the table of charges shows great differences in current practice as regards the size and kind of motors involved in the installations. For example, one plant doing a very large business with nearly 40,000 hp of motors connected, showed large motor capacity with respect to the population, proving that the field had not been neglected, and yet a very low income, only $15.73, annually per horse-power installed. So low a figure as this calls attention to the probability that the business has not been properly exploited with respect to the capacity of motors installed. One would naturally expect to find with so small an income per horse-power a low rate for energy sold, which, on the contrary, in this instance, the average rate per kw-hour is 5.58 cents and the kw-hours sold per horse-power installed are in this plant the lowest in the entire list. It is obvious that such an instance gives chance for great improvement in the character of the load.

In other instances there appears to be a great negligence in working up a proper amount of load; for example, the city in Mr. Adams' list which pays the highest price had the least horse-power in connected motors, the least income per inhabitant, the least horse-power with respect to the population. Nevertheless, this particular city with only 616 hp connected motor load had more than 50,000 hp of steam engines operating manufacturing plants. Apparently no serious effort had been made to obtain motor load in spite of the enormous market. Either the price had been set at too high a figure or the business department of the station had been hide-bound in its methods. Certainly, if 50,000 hp in manufacturing is fairly at the doors, it seems inexcusable in any properly administered central station to have a motor load hardly over 1 per cent of the possible. A case little more creditable is another in the table in which the income from motors per inhabitant is down to only 28 cents and the connected motor load is 1192 hp, while the factories of the city aggregate more than 100,000 hp in engines. Only a small amount of water-power was available for competitive purposes, for the total horse-power in water-wheels in the city was about 1000. The electric rate was about 5¾ cents per kw-hour, and it would be interesting to know what sort of sluggishness had overwhelmed the central-station management to limit the motor load to hardly over 1 per cent of the regular engine load of the city. Surely, any place with 100,000 hp in steam engines would be a profitable field for the use of electric motors at any sort of reasonable price for energy. In the cases just mentioned, a cut in the price of energy would probably have largely increased the net profits, yet the central station was content to hold up its price and do a petty business.

As a whole, the motor service in the group of cities studied does not seem to be anything like as large as it should be in comparison of the horse-power of the steam engines regularly in use, although in one case, the largest city of the group, the motor horse-power actually exceeded the engine horse-power; yet in this very case the motor equipment seems to have been unwisely installed, for the price per horse-power installed was brought exceedingly low in spite of a rate for energy which would ordinarily be too high to win a large part of the power market. The long and short of the matter appears to be that the motor market in these American cities, as in most others, has not been thoroughly and intelligently developed. Installations have not been systematically planned and the prices set have not as a rule been judiciously arranged. The available market narrows enormously if the price for energy is set too high. All the larger units, as a rule, cannot be attracted to central-station service at a price materially or at all above 3 cents per kw-hour. Sometimes failure to take on profitable load is chargeable to an unwisely planned system of rates too inflexible to serve its ends properly. A motor business properly administered is a very profitable part of central-station work and deserves to be cultivated. It demands, however, a system of rates which will enable the fair-sized motor units to be taken on at a price which would be profitable to the user as well as to the central station.

Governor Hughes Recommends that Telegraph and Telephone Companies Be Subjected to State Legislation.

Governor Hughes, of New York, in his annual message to the Legislature, renews his recommendation to extend the powers of the Public Service Commissions to include telegraph and telephone companies in order that these companies should be brought under appropriate regulation as to rates, service and other matters, similar to that which has been provided for corporations at present subject to the law. "The events of the past year have," he said, "served to emphasize the importance of adequate supervision and regulation, and I know of no sound reason for excluding these activities from the established policy of the State." He also recommends such amendments to the law as experience has shown to be advisable to improve its provisions to aid in its administration, and to carry out the intent in the statute.

It is said in Albany that the legislative committee, which has recently investigated telephone and telegraph matters, will probably recommend the control of the operations of these companies by the Public Service Commissions to the extent that these operations affect the public—in the matter of rates and service. It is reported, however, that it will not recommend control of their financial management. It may be several weeks before this committee renders its final report, and submits the draft of a bill to the Legislature. It is not believed that the recommendations of the committee will go far enough to meet the ideas entertained on this subject by Governor Hughes, and expressed in his message. It is said that the committee is of the opinion that the recent decision of the Court of Appeals, limiting the powers of the commission in passing upon the financial management of railroads, has furnished ample ground for relieving telephone and telegraph companies from such supervision.

Special A. I. E. E. Meetings.

A special meeting of the American Institute of Electrical Engineers will be held in Charlotte, N. C., on March 23, 24 and 25. Other meetings of a similar character will, it is reported, be held in Boston, San Francisco and elsewhere. According to a Southern correspondent, the decision to name a Southern city was induced largely by arguments presented by Mr. W. S. Lee, general manager and vice-president of the Southern Power Company, whose headquarters are in Charlotte. Mr. Lee, when in the North recently, appeared before an Institute committee and forcibly presented the claims of the Southern town for consideration. The selection of Charlotte has caused the greatest satisfaction in that city, as this will be one of the largest and most important gatherings ever held in that place. The Greater Charlotte Club will have the entertainment program in hand, and is already making preparations for an elaborate three days' sightseeing, social pleasure and outings. There will be a number of committees appointed at once to begin the work of preparation. The Engineering Society of the Carolinas, through its members, will aid in looking after the success of the approaching meeting, and the extensive electrical developments within a 75-mile radius of Charlotte will be one of the special features to which the attention of the visitors will be called.

Wilbur Wright Criticises Patent System.

Mr. Wilbur Wright, the aeroplanist, in a statement relating to our patent system, says that our patent laws are "not right," and that the German system is better. "There," he says, "a man who wants to follow the lines of a patent must first go to court and show his intentions. He must file a bond before beginning operations. Under our system a man can get his knowledge from the patent. Then he says, 'I have more money than that chap; I'll go ahead, and in the years the litigation is going forward I'll make my profits, and so fix them that he cannot collect them.' The patent laws now do not give protection. A man ought to have better security. It is almost impossible now to collect a bill till the value is gone. That is largely because of the time occupied with litigation. Just when a man ought to be doing something, he has to stop and fool around with the law, or else lose everything. There should and could be quicker ways of adjusting these matters. There is no case where the general facts could not be set forth, and settlement reached within a year."

Proposed Maryland Public Utility Commission.

The Governor of Maryland in a message last week to the State Legislature advocated the enactment of a public service commission law. He said that the reasonable and just regulation of public service corporations through the agency of a commission with prescribed powers and duties has, as a policy, been adopted by a number of the largest and leading States of the Union and is under favorable consideration in many other States. "The fact is so obvious as to dispense with the necessity of prolonged discussion that a public service commission in the State of Maryland, as in other States, will shield and secure the people from injustice, abuse and disadvantage of whatsoever form at the hands of great corporations engaged for their own profit in the sale and supply of the utilities and service of a general and public nature, and will reasonably guarantee to the people adequate and proper service at just prices. The people are entitled to this in respect to the utilities in question—that is to say, that they are entitled to justice, no more, no less. On the other hand, the same measure of regard and consideration is due to the capital and corporate and personal interests engaged and involved in the organization and maintenance of the public service corporations of this State. These institutions, it cannot be denied, are often subjected to unreasonable demands and unjustifiable attacks. They, too, are entitled to justice—no more, no less. A public service commission, clothed with the necessary powers and charged with appropriate functions, and above all else, composed of men imbued with a full measure and high standard of intelligence, character and public spirit would meet these requirements and subserve and accomplish the great public end in view which, after all, is the full preservation to the people of the rights and advantages to which they are justly entitled without imposing unnecessary or unreasonable burdens upon the corporations in question. To effect this rightful object, which indeed is one of the salutary ends of government itself, it is indispensable that not only such a commission be provided for by the Legislature, but that it be vested with plenary powers to effectually and impartially accomplish its important object with respect to all public-service corporations in the State in their various relations to the people. This is the spirit and the design of the pledge we made to the people. Without hesitancy or shortcoming in any particular, let us now faithfully redeem it."

The Morgan Telephone Deal.

Mr. F. A. Davis, president of the Citizens' Telephone Company, of Columbus, Ohio, after a consultation with members of the firm of J. P. Morgan & Company, said he was authorized to state in most emphatic terms that the companies of which Morgan & Company have lately secured control will remain independent and that the action of the firm in buying the securities had no connection with the Bell interests whatever. A letter had been written to Attorney-General Denman, of Ohio, to that effect, and Mr. Davis was authorized to consult with him and make the statement even stronger than the words of the letter conveyed if he could find expression for such a statement.

Mr. Davis will become president of the United States Telephone Company, with headquarters in Columbus, and have general supervision of the properties which J. P. Morgan & Company now control in Ohio. He will also remain as president of the Citizens' Telephone Company. No changes in the directo-

rate of this company are contemplated with the exception of the addition of a member of the firm of J. P. Morgan & Company to the number. Mr. Davis said that the long-distance lines will be extended and the general independent policy pursued. It is reported that Mr. Davis and a number of other Columbus men are again heavily interested in some of the companies under the Morgan control and that they will take places on the United States directorate as successors of the men who have sold their interests.

Attorney Harrison B. McGraw, of Cleveland, acting for the minority stockholders, has requested that Attorney-General Denman furnish him with copies of the letters received from J. P. Morgan and officials of the several companies now under their control, in which they deny that there is any alliance between Morgan and the Bell interests. Mr. McGraw still insists that the Attorney-General has by delaying to file suits to prevent the transfer of the securities to Morgan & Company missed the best opportunity that will be offered him for serving the people. Attorney-General Denman has not replied to any of the criticisms made regarding this matter, but insists that there has not been sufficient evidence produced to warrant him in bringing suit. The increase in rates made recently by the United States Telephone Company, he says, is not sufficient evidence. If the rates had been met by the Bell, then this might have supplied the missing link, but so far no move of that kind has been made. If in the future there are indications that the companies are working together he will take action, he said, or if further evidence can be produced, he will follow the course advised by Attorney McGraw.

Attorney-General Denman has received letters from J. P. Morgan & Company, Theodore N. Vail, president of the American Telephone & Telegraph Company; James S. Brailey, Jr., president of the United States Telephone Company, and other telephone officials all denying any affiliation between Morgan and the Bell people. The letter from J. P. Morgan & Company expressly states that there is no agreement between the American Telephone & Telegraph Company by which the Independent systems controlled by the firm will be operated under one control and that they did not act as brokers, bankers or agents for any one, the securities being purchased as an investment. The fact that H. P. Davidson, of the Morgan firm, is a director of the American Telephone & Telegraph Company is merely a coincidence, it is said.

Mr. Clarence Brown, attorney for J. P. Morgan & Company in Ohio, has forwarded to Attorney-General Denman a copy of the resolutions adopted at the annual meeting of the National Independent Telephone Association providing for the accumulation of a fund of $150,000 for the purpose of taking care of the interests of members, and suggests that the expenses of the injunction cases now pending against the United States and Cuyahoga Telephone companies are being paid from this fund. He declares that there is animus in the action of the association in arranging for such a fund. The resolution has a subscription blank attached and is probably one of the papers sent out to a member of the association.

Telephone men in Ohio are anxious to learn the purpose of the State Telephone Company incorporated at Albany, N. Y., a few days ago, with authority to operate lines in several States, including Ohio. Some of them seem to see in it a holding company for the properties which have recently passed into the hands of J. P. Morgan & Company.

McBerty-Fowler Telephone Interference.

On Jan. 4 the Court of Appeals for the Seventh Circuit, Judge Grosscup writing the opinion, handed down its decision finally settling the interference case between Frank R. McBerty and Samuel B. Fowler, relating to the "Telephone System" of the McBerty patent No. 817,867 of April 17, 1906. The decision was in favor of McBerty, reversing the decision of Judge Kohlsaat, which had been in favor of Fowler. The case has been vigorously contested through the Patent Office and in the Court of Appeals for the District of Columbia. The Patent Office and Court of Appeals for the District of Columbia held in favor of McBerty. The litigation extended over a period of three years before the present suit was commenced in the spring of 1906. The case just decided was prosecuted by Fowler against the Western Electric Company and McBerty under Section 4915 of the Revised Statutes. The records consisted of more than 1500 printed pages and there were over 500 pages of briefs. In all there were six independent hearings with oral arguments which required the attention of 12 judicial officers. McBerty was represented through all the litigation by George P. Barton, DeWitt C. Tanner and George E. Folk. Fowler was represented by Charles A. Brown, Lynn A. Williams and John F. McHugh.

Telephone Competition in Chicago.

It is now evident that the announcement of Mr. H. D. Critchfield at the Independent telephone convention a month ago, reported in these columns Dec. 16, that an active competing system of 20,000 telephones would be in operation in Chicago within a year from that time, was based on a knowledge of the plans for reinstating and extending the telephone service of the Illinois Tunnel Company. Mr. C. O. Frisbie, agent for the receivers of the tunnel interests, following a careful consideration of the subject by the reorganization committee of the tunnel company, says that a new plant having a capacity for 20,000 telephones will be built, and that connections will be made very soon with outside long-distance Independent toll lines. Automatic apparatus will be used, and a 10-year installation and maintenance contract has been executed with Mr. Joseph Harris, president of the Automatic Electric Company, for the new plant. The Tunnel company has automatic telephones and switching apparatus in its present inactive plant, but the system was put in 10 years ago or more, and is now entirely out of date. The old apparatus will be entirely discarded, no doubt.

Under its extended franchise the company has until June, 1911, to have 20,000 telephones in use in Chicago, but an effort will be made to reach that figure before that time. The maximum rates allowed are $85 for unlimited business service and $60 for unlimited residence service. It is declared that the rejuvenated company will compete actively with the Chicago Telephone Company and that a guaranty of this lies in the fact that it will employ the improved automatic system, while the Chicago Telephone Company, like all the large Bell companies, uses manual apparatus. The Tunnel company has not paid interest on its bonds, and it is contended that a strong telephone system will be a good income producer. Owing to the relations of the Chicago Subway Company, holding company for the Tunnel, with important railroad and financial interests, the Tunnel company has strong connections, including the Harriman estate, New York Central Lines, and Mr. J. Ogden Armour. To what extent these interests will enter actively into the Bell-Independent telephone fight remains to be seen.

Philadelphia Electrical Exhibition.

A meeting of the representatives of the electrical interests in Philadelphia was held in the Engineers Club, on Jan. 7, to discuss the final arrangements for the Philadelphia Electrical Exhibition to be held in that city Feb. 14 to 26. Mr. W. C. L. Eglin, past president of the National Electric Light Association, occupied the chair.

Details of the booth construction, decorations, publicity campaign, etc., were discussed and a publicity committee consisting of the advertising managers of the several electric public service companies of the city was appointed.

An advisory committee consisting of prominent citizens and business men, with the Hon. John E. Reyburn, Mayor of Philadelphia, as chairman, was also appointed. The exhibition is rapidly assuming a civic character, and promises to be one of the most varied and comprehensive of this character ever held; and the number and variety of exhibits already secured, six weeks in advance of the opening date, augur well for the success of the project.

Colorado Electric Club.

The Denver electrical men who have been meeting informally for lunch for about six weeks past, as before mentioned in these columns, made a formal organization at a meeting Jan. 5, under the name of Colorado Electric Club. After lunch, which was held at the Kaiserhof, Mr. B. S. Manuel, of the Westinghouse Electric & Manufacturing Company, called the meeting to order. After a few minutes of diversion in the form of witty speeches, Mr. C. N. Stannard, secretary of the Denver Gas & Electric Company, was called on to make a report as chairman of the committee on organization. The constitution adopted, as a result of this committee's recommendations, provides that the management of the club shall be in the hands of an advisory board of seven members, who shall elect officers. A chairman shall be elected every month who shall have charge of and be responsible for the meetings for a month. The membership is to be limited to 500. The organization committee, in addition to submitting a constitution, recommended that the first advisory board consist of the following men, who were chosen by the committee as representing nearly all the classes of electrical men in the city: Messrs. George A. Woolley, of the General Electric Company; B. S. Manuel, of the Westinghouse Electric & Manufacturing Company; C. F. Oehlmann, of the Denver Gas & Electric Company; W. P. Carstarphen, of the Carstarphen Electric Company; Walter F. Brown, of the Colorado Telephone Company; W. G. Matthews, of the Denver Tramway Company, and H. L. Wolfenden, consulting engineer. This committee was duly elected. For chairman in charge of meetings for the first month, Mr. J. B. Griffith, of the Nernst Lamp Company, was chosen. Mr. J. R. Cravath, associate editor of the *Electrical World*, was called upon as a member of the Chicago Electric Club to give his ideas regarding the Denver organization. He explained that the form of organization and methods of conducting the club as proposed were similar to that successfully used at Chicago, except as to the plan of electing a chairman for a month only and holding him responsible for the meetings and speakers provided. He thought this Denver plan better than throwing on a single committee for a year the rather burdensome duty of providing speakers.

Chicago Electrical Show Next Week.

What promises to be one commendable feature of the fifth annual Electrical Show to be held in the Coliseum, Chicago, Jan. 15 to 29 inclusive, is its completeness. The sale of exhibit spaces some time in advance of the date of the opening of the show was larger than ever before, and at this writing practically all the central spaces have been taken, although a few of the spaces around the sides of the building still remain open. It is believed that the exhibits will be ready for inspection promptly on the opening day, and there is every prospect that the show will be most successful in every way.

The largest exhibitor will be the Commonwealth Edison Company, which will have not only a large power exhibit at the north end of the hall, but also a model garage and a lecture hall for popular addresses at the south end. In addition, the Electric Shop of this company will have a display of handsome electric portable and piano lamps near the northwest corner of the Coliseum. In all there are about 100 exhibitors, a large proportion of the prominent electrical manufacturing concerns in the country being represented. The exhibition will be particularly rich in exhibits relating to electric lighting, electric signs, heating and cooking devices, domestic appliances, vibrators, vacuum cleaners, electric automobiles, storage batteries, telephones, wire, carbons, motor applications for general industrial purposes, and various small electrical appliances. A novelty will be electrically heated bathrobes and other clothing. The *Electrical World* will have the same space (F. 21) as last year.

The scheme of decoration is a rather daring one and should be particularly effective. The general floor lighting will be supplied by 60 100-watt and 150-watt tungsten lamps mounted on posts in globes or suspended from low arches under dome shades. In all there will be about 1200 tungsten lamps. There is also a special plan of illumination for the frieze around the balcony. The great innovation, however, will be in the upper part of the hall. Here a myriad of gold and silver tinsel ribbons of varying length will depend from a dead-black ceiling. The light from six powerful searchlight projectors will be thrown on these scintillating streamers undulating in the air currents of the large interior, and the effect should be brilliant. So closely together will these tinsel ribbons be hung that it is said that 30,000 yd. of this material will be required. The projectors used were some of those employed at the recent Hudson-Fulton celebration in New York, and they were installed under the direction of Mr. G. H. Stickney, of the illuminating engineering department of the General Electric Company.

Suspended from the roof will be the aeroplane purchased by the United States Government from the Wright Brothers. This popular attraction will be in charge of Lieutenant B. D. Foulois, of the Signal Service of the United States Army. It will be equipped for "wireless" communication, of which daily demonstrations will be made. A blanket insurance policy for $10,000 has been taken out by the Electrical Trades Exposition Company covering the airship during the period of the Show.

A special effort will be made to increase the daytime attendance this year, and both the Chicago Telephone Company and the Commonwealth Edison Company are sending out to their customers, with the monthly bills, coupons good for half-price admission if used during the Electrical Show on any day before 5 p. m. During the show there will be a number of "special days" particularly devoted to various electrical societies, such as the Wisconsin Electrical Association, Illuminating Engineering Society, Sons of Jove, American Institute of Electrical Engineers, Electric Club of Chicago and Thomson-Houston Association. Attractive souvenirs will be distributed to paid admission visitors.

No expense has been spared by the management of the exposition company to make this show not only extremely attractive to the non-electrical public, but also really representative of the electrical development of the day in the field of lighter apparatus.

Annual Show of the Association of Licensed Automobile Manufacturers.

The tenth annual show conducted under the auspices of the Association of Licensed Automobile Manufacturers opened in Madison Square Garden, New York City, on the evening of Jan. 8, and will continue until Jan. 15. The exhibition is the largest ever conducted by the association, it being impossible to accommodate all of the applicants for space, even by cutting down the size of the booths. All the available space in the Garden, including the immense arena, the balconies encircling it, the concert hall, the restaurant and the basement below the arena is utilized. In all there are 323 different exhibits, 54 being of completed cars propelled by gasoline, electricity and steam, 23 of motor cycles, and 246 of accessories and parts. In the restaurant there are nine manufacturers of electric pleasure cars represented, and in the basement under the arena three manufacturers of commercial electric vehicles have a number of cars on exhibition.

The majority of the gasoline cars on exhibition are equipped with engines having four cylinders, while the number of engines having six cylinders is rapidly increasing. The magneto and jump spark are used almost exclusively for ignition purposes, the former being supplemented by storage batteries or dry cells. There are no startling departures from standard practice, inasmuch as the makers grouped under the Association of Licensed Automobile Manufacturers have always been conservative. The tendency, moreover, has been to standardize as much as possible, and the association has already done much in bringing forward a standard spark plug, which has almost entirely replaced 20 or more sizes with which accessory makers were formerly com-

pelled to struggle; standard bolts and nuts; standard rod ends and yokes, and a standard method of rating engines. All of the electric pleasure vehicles are equipped with one motor, the largest on exhibition being rated at 3½ hp. The number of cells of battery varies, of course; and, while the majority of the vehicles are equipped with batteries of the Exide type, a few are equipped with the Edison battery, which is now being turned out in quantities. Silent chain and herring-bone gear are used in the first reduction from the motor to the countershaft, and bevel gear, herring-bone gear, spur gear, single chain, and double chain in the drive. Ball bearings are used exclusively on the motors and transmission, while ball and roller bearings are used on the axles.

For the purpose of providing a suitable setting for the exhibits, an elaborate decorative scheme has been worked out. When it is realized that it is considered necessary to change the style of decoration for each show given in Madison Square Garden, the task of devising something entirely new will be appreciated. In the present automobile show the Garden interior has been given satisfactory treatment, although the scheme is less profuse than ordinary. The bare walls, steel girders and balconies of the Garden are lost to view, and the whole interior transformed to represent a Roman amphitheater of dignified architectural design. In deciding upon the semblance to a Roman amphitheater, the primary thought was to obtain from the big arena a general impression of spaciousness, and no point was lost of which advantage might be taken, the layout of the exhibitors' spaces, of the galleries, elevated platform, railings, and even the signs, lending themselves to this effect. At the early shows the ensemble of exhibits was cluttered with so much decorative frippery that the magnitude of the whole was not fully realized, and at the show this year there is a noticeable absence of plaster casts, bunting, rubber plants, palms and other paraphernalia tending to interrupt the general view. The idea of uniformity in the decorations has been carried out so completely that even the smaller spaces in the gallery have received the same attention as those on the main floor. White and gold are the predominant colors in the scheme, and green and crimson are also in evidence. The girders of the big dome are screened by a canopy of fluffy azure blue cloth, broken up by strings of incandescent lamps fastened to the bottom of the roof girders. The arena is chiefly illuminated by means of flaming arc lamps and two immense chandeliers.

At brief intervals along both sides of the long aisles, extending the length of the arena, are ornamental lamp-posts 8 ft. high, and finished in verde-bronze. The lamp shade contains the names of the exhibitors adjoining and also directions to the various departments of the show. There are 50 of these lamps on the main floor, and about 30 on the elevated platform. Entering the arena from the foyer, the visitor is confronted by a Roman seat extending about a fountain. The seat is in front of a low abutment of gray stone and integral with it. The fountain is a trough-like basin, in which gold fish disport themselves with natural pond lilies. Interspersed with natural flowers are artificial water plants, from the petals of which vari-colored incandescent lamps radiate. In the center and at each end, water from the mouths of grotesque heads plays upon the pool beneath, made iridescent by cunningly concealed lamps. Extending around all the outer edge of the elevated platform, and towering upward to the dome, 30 classic doric columns lend much to the stateliness of the effect. On top of each of these 25-ft. columns is the emblem of the association, a wheel surmounted by an American eagle. The columns are white, while the emblems are old gold and are studded with electric lamps. The elevated platform, which projects slightly over the main floor and over the boxes, is also supported by white doric brackets. A white balustrade extends along the outer edge of the elevated platform, and the walls of the back are coated with a cartridge paper of rich golden hue, on which the exhibitors' names appear in white letters on a board background of crimson.

The concert hall is made to resemble a circus tent, a large dropping sheet of canvas covering the ceiling, while the room occupied by the electric vehicles is made to represent a latticed arbor. The basement of the Garden is decorated in a harmonious manner, similar to the treatment in the other departments of the show. The ceiling is covered with a specially woven cloth, and strings of electric lamps extend around the exhibitors' spaces. In the basement is also housed one of the most pretentious displays of automobile trophies ever given in this country.

Wireless Telegraph Measurements.

At a regular meeting of the Wireless Institute, held at the Engineering Societies Building, on Jan. 5, Mr. L. R. Gleason presented an interesting descriptive paper on measurements and measuring instruments in wireless telegraphy. The units in use were first taken up, and the centimeter of inductance ($= 10^{-9}$ henry) and the microfarad of capacity were recommended for general calculations of oscillation circuits.

Fleming's cymometer was described as representing a typical wave-length measurer, and the fact that its scales give direct readings of the three interdependent functions, wave-length, frequency and oscillation constant ($\sqrt{CL}$), was emphasized. It was also brought out that in this instrument the scale divisions are uniform, which characteristic allows equal accuracy in readings throughout the range of the apparatus, and renders calibration a simple matter.

Other frequency meters considered were those of Seibt, Dönitz, Slaby and Marconi. In the Seibt meter the oscillation circuit is formed by a four-step condenser and a variometer inductance (the type of Ayrton-Perry standard), the latter providing means for continuous variation of the circuit's oscillation constant. In Dönitz's instrument use is made of a set of three interchangeable inductors of fixed inductances, and a segmental condenser of variable capacity with oil dielectric. Both the Seibt and Dönitz apparatus are arranged to allow the plotting of resonance curves between current and frequency, the former using a thermo-couple and millivoltmeter, and the latter having an inductively coupled air thermometer for measurement of current.

Marconi's new portable wavemeter was considered, and the construction of its segmental variable condenser was described in full. By a novel arrangement of the condenser plates this instrument is made very compact; in fact, it occupies just one-half the volume of a variable-capacity condenser of the standard construction and the same maximum capacity. One of these new condensers was shown. The use of hard-rubber dielectric is not advisable, since it makes the apparatus unsuitable for use even as a secondary standard.

A new resonance meter, manufactured by the Radio Telephone Company, was also considered. In this instrument a number of inductance coils are arranged with plug terminals, and a variable-capacity segmental condenser forms the element having continuous change of capacity.

Mr. Gleason stated that he had found the approximate formula for self-induction

$$L = (\pi d n)^2 l$$

(which is fairly accurate for coils in which the ratio of length to diameter is large), to agree within 1 per cent with values measured by the Bureau of Standards on a coil in which $\frac{l}{d}$ was nearly unity; and he believes that the expression will allow accuracy of this order whenever the wire and spacing on the coil are very small. In the formula L is induction in centimeters, d diameter of coil, n number of turns per centimeter of length, and l length in centimeters.

In the discussion which followed the reading of the paper, the respective merits of the resonance-type meters having variable inductance and those having variable capacity were taken up. Each possesses good points, but the balance of favor seems to incline toward those instruments which have fixed capacity and a variometer alteration of the circuit's self-induction. To prevent change in the e.m.f. induced in the meter the coupling coil should be made independent of the variable self-

inductance. The need of protecting the meter from stray fields was also pointed out.

The possibility of constructing frequency meters not dependent on resonance was suggested; and the variation with frequency of resistance of a solid conductor was proposed as a basis for such a device. The paper and discussion proved very interesting, and the only disappointment was that the measurement of important quantities other than wave frequency was not taken up.

Domestic Electricity.

At a meeting of the New York Electrical Society, held on Dec. 29, Mr. Frank H. Gale, of the General Electric Company, delivered an illustrated lecture on the subject of electricity for every social service. The speaker described various electric radiators, toasters, water-heaters, stoves, motor applications and illuminating arrangements. Attention was called to the fact that the owner of a certain house designed for using electricity for all lighting and heating purposes, by reason of the lack of chimney, stoves and coal storage room, was able to save enough to pay the whole cost of the electrical installation. In localities where fuel is expensive and water-power is plentiful, electricity for heating may prove the least expensive of all possible agencies. Under usual conditions the cost of operating electric heating devices is greater than for obtaining the same service by means of coal or gas, but certain devices may prove even less expensive in operation than gas on account of the rapidity of action of the electric heat. On the basis of cleanliness and convenience the electric heating service is far preferable to any other. Mr. Gale expressed the opinion that in planning a new house electric service outlets should be provided at suitable positions in each room.

Mexican Electrical Developments.

There are several large electrical enterprises and development work in the matter of extensions of existing energy transmission lines in prospect in Mexico for 1910. American and Canadian financiers are chiefly interested in the new project, as well as being in control of the concerns that are already established.

The Mayo River Power & Land Company, which has its headquarters at Denver, Col., is preparing to erect hydroelectric plants upon the Mayo River in the State of Sonora for the purpose of developing a large amount of power. Surveys have been made for a series of dams which the company will build across the river in order to obtain the necessary supply of water for operating the proposed hydroelectric plants. The first of these dams will be located near the town of San Bernando, close to the new line of the Southern Pacific Railroad, of Mexico. Mr. R. M. Jones, of Denver, hydraulic engineer of the company, and Mr. R. E. Cowden, the superintendent are now at the site of the proposed dam making the final surveys and soundings preparatory to starting the work of construction. It is said that the initial plant will have a rating of about 25,000 hp. The other dams and hydroelectric plants will be built as the demand for energy increases. The company has a capital stock of $5,000,000 gold. It owns the power concession which was originally obtained from the Mexican Government by Mr. W. O. Temple, of Denver.

Within a radius of 150 miles of the sites of the proposed hydroelectric plants on the Mayo River are probably 50 thriving mining camps and towns which will be greatly benefited by the cheap energy that the company intends to furnish. Transmission lines will be built to all of these mining and industrial centers. It is expected that the establishment of this big electrical enterprise will serve to stimulate greatly the industrial development of a large scope of territory in Western Mexico.

The two great hydroelectric transmission concerns, the Guanajuato Power & Electric Company of El Duro, of Michoacan, and the Chapala Hydroelectric & Irrigation Company, of Guadalajara, are preparing to wage strong competition for a large scope of territory which can be reached by their respective transmission lines. Both companies have been investigating the situation in the city of Aguascalientes and adjacent district with the view of embracing them within their transmission systems. There are a number of large mining camps around Aguascalientes which will be supplied with energy from the lines of the Guanajuato Power & Electric Company. The Chapala Hydroelectric & Irrigation Company will soon have its transmission line completed to the mining districts lying to the west of Guadalajara. It has adopted plans for reaching the territory situated to the east and northeast for a distance of nearly 200 miles. It is announced that the mining district and city of Zacatecas are to be brought within touch of the transmission lines of both of these companies. Zacatecas is already within 50 miles of one of the branch lines of the Guanajuato Power & Electric Company. It is predicted by practical mining men that the introduction of cheap electric serice to the Zacatecas mining district will cause a revival there equal to that which was wrought in the Guanajuato mining district from a similar cause. The Zacatecas district has a wonderful record of mineral production and its ore dumps are said to be the largest and richest in Mexico. When cheap energy is obtained the old mines can be reopened and worked profitably and much new mineral development will be inaugurated, it is claimed.

At a recent meeting of the stock and bondholders of the Mexican Northern Power Company, a Canadian concern, an enlargement of the hydroelectric plans was decided upon. Instead of the development of 15,000 hp, as was originally contemplated, the hydroelectric plant, which is to be erected on the Conchos River, near Santa Rosalia, Chihuahua, will have an initial equipment of 45,000 hp. It is announced that the adoption of these enlarged plans involve the expenditure of much more money, and in order to carry them out the bond issue has just been increased from $7,500,000 gold to $10,000,000 gold, and the stock issue from $10,000,000 to $15,000,000 gold. The company has entered into many contracts to furnish electric energy for the operation of mines, mills and other industrial plants in the cities of Chihuahua, Parral, Jiminez, Santa Rosalia and the mining camps situated within a radius of 150 miles. Under the terms of these contracts the consumers are to pay $100 per horse-power per year. The company has let the contract for the construction of the entire works to the English firm of S. Pearson & Son, Ltd. Mr. G. F. Greenwood, of Montreal, Canada, is president of the Mexican Northern Power Company. The preliminary work on the construction of the dam across the Conchos River has already been started.

The Chapala Hydroelectric & Irrigation Company, which recently obtained an exclusive concession from the Government of the State of Aguascalientes for the transmission of power to the city of Aguascalientes and the several different mining camps of that State, is negotiating for similar franchises from the States of Zacatecas and San Luis Potosi. It is announced that the building of the necessary transmission lines will be started very soon, and that they will be finished before the end of the present year. These lines will have an aggregate length of more than 400 miles. The company is already building transmission lines to important mining camps in the State of Jalisco. It now has two hydroelectric plants on the Santiago River in the State of Jalisco and is completing a third. This last-mentioned plant will have a capacity of 18,000 hp. The plans of the company include the building of a canal about 15 miles long, by which means the available horse-power will be brought up to 90,000. The company, in its contract with the State of Aguascalientes, agrees to deliver to power users in that State within two years a minimum of 2000 hp at a rate of not more than $100 per horse-power per annum in the city of Aguascalientes, and not more than $125 per horse-power per annum in the mining camps. The same financial interests that control this company also own the electric street-railway system and light plant in Guadalajara and the electric street-railway system in Aguascalientes.

The Mexican Northern Power Company, the Canadian con-

cern which is arranging to erect hydroelectric plants in the State of Chihuahua, has obtained a new concession from the Mexican Government, giving it authority to build two great dams and hydroelectric plants upon the Conchas River. The site of one of these dams is at Boquilla, 17 miles above Santa Rosalia, and the other at La Joya. The construction of the dam at Boquilla is already in progress. The company is also building a railroad from Santa Rosalia to the site of the dam. This first dam will have a water supply sufficient to generate about 30,000 hp, according to the estimate of engineers. The plant at La Joya will have a capacity of about 40,000 hp.

More than 2000 laborers are employed in constructing the new canal for the Compania Electrica e Irrigadora, near Pachuca, which is to afford power for the new hydroelectric plant of the company that is to be erected at Tetapango. This canal will be about 25 miles long, and will be completed in about eight months. This company is furnishing power for a number of mines and mills in the Pachuca district. It is now operating two hydroelectric plants, each of 6000 hp.

It is announced by Mr. W. O. Temple, secretary of the Mayo River Power & Land Company, that the plans and specifications for the dams and hydroelectric plants which it will erect upon the Mayo River, in the States of Chihuahua and Sonora, will be finished by April 1, and that the work of construction will be started soon after that date. The first of these dams will be built near the line between the States of Chihuahua and Sonora, but in the latter State. Later two or more dams will be built across the river in the State of Chihuahua. Transmission lines will be built to all of the larger mining districts in that part of the country. The company has its headquarters in Denver, Col.

The great dam which the Mexican Light & Power Company is building at Necaxa, near the City of Mexico, and which will be finished about July 1, will be the largest dam of its kind in the world. Dr. F. S. Pearson, who is at the head of this company, in speaking of the Necaxa project, said: "When this dam is completed we will have an all-the-year-around supply of 100,000 hp. This will have been increased by 32,000 hp more by 1912, when the tunnel shall have been finished to turn the water of the Zampoalan River into the Necaxa reservoir. Later we will build a second power plant below the present falls, which will give us an additional 100,000 hp, an amount of energy that we shall not be able to dispose of for many years."

The Batopilas Mining Company has made a survey of the Batopilas River in the Batopilas district, State of Chihuahua, and it shows a fall of 1000 ft. within its property lines. The company will erect a hydroelectric plant near Batopilas for the purpose of providing power for operating its mines and reduction mill.

The Navidad Reduction & Mines Company, of San Francisco, Cal., which obtained a concession from the Mexican Government some time ago for the use of the water of the Ameca River, near San Sebastian, State of Jalisco, will soon be ready to start construction work.

Work of Baltimore Electrical Commission.

At a meeting of the Electrical Commission of Baltimore, Md., which was held last week, Engineer Charles E. Phelps, of the Subway Commission, submitted his annual report. The report shows that in 1909 a total of 872,576 duct feet of conduit was laid in 17.5 miles of street; 392 manholes were built and connections made into 1019 buildings at a construction cost of $231,919.99. As now constructed, the system comprises a total of 8,405,789 duct feet of conduit laid in 128 lineal miles of streets; 3216 manholes and 6297 house connections, the total cost being $2,218,733.12. There are drawn into the conduit system at the present time 1,955,389 ft. of cable of all classes, of which 1,867,034 ft. are productive, while 88,355 duct feet are rated as unproductive, paying no rental, comprising fire alarm, police, telegraph, municipal and Government cables. Up to Jan. 1, 1909, there was collected a total duct rental of $364,299. and the earnings for 1909 were $109,974, making a total to date of $474,274.76.

The cost of operating and maintenance during 1909 was $8,462.60, while the operating and maintenance of the entire system to date has been $57,369.11. The Electrical Commission consists of Mayor Mahool, Mr. Parrish and City Register Thomas. Favorable comment was made on the statement of the year's work, Mr. Thomas saying that financially it represented a 4 per cent return on the investment. The commission unanimously elected Mr. Raleigh C. Thomas assistant engineer and Mr. W. T. Mitchell to the position of chief cable inspector.

Massachusetts Legislative Notes.

The Massachusetts Legislature convened at Boston on Jan. 5 with the prospect of an unusually busy session before it in connection with public-utility questions. Hon. Joseph Walker, of Brookline, was re-elected Speaker of the House, and Senator Allen T. Treadway, of Stockbridge, was re-elected President of the Senate. Governor Draper's inaugural address contained practically no references to public-utility matters of electrical interest.

On Jan. 10 the Massachusetts Railroad Commission and the Boston Transit Commission, acting as a joint board, submitted an exhaustive discussion to the Legislature upon various transportation questions of pressing interest at Boston. The most important topics from the engineering point of view covered by the report were the recommendations of the board for legislation permitting the Boston Elevated Railway Company to acquire control of six connecting systems, forming a single operating organization having jurisdiction over 1700 miles of track, and advising the passage of a resolution authorizing the Boston Transit Commission to make studies of the cost of building a cross-town tunnel in Boston from Park Street to the South Station. Another recommendation was that the Boston Elevated Railway Company and the Boston & Northern Street Railway Company enter into an agreement for the joint use of the East Boston tunnel, pursuant to the construction of a loop at Scollay Square to increase the tunnel's traffic capacity about four-fold, with the establishment of transfer privileges at the tunnel stations by the Boston Elevated Company.

The action of the board in the matter of the acquisition of outlying companies throws upon the Legislature the question of permitting the Boston Elevated to extend greatly its usefulness in Eastern Massachusetts, and suggests that a new era of electric railway administration may be at hand in the operation of the separate street railway lines centering on Boston. The board states that such an extension of the Boston Elevated, under proper legislative control, will tend to unify the system of transportation focused upon Boston, to increase accommodations and decrease rates. This result should be secured through the large financial resources and efficient means and methods of operation of the Boston Elevated Railway Company.

The board calls attention to the benefits resulting from earlier consolidations in the way of reduced fares and increased facilities. Where the combination was not made effective, as in the area immediately north of Boston, the traveling public are sustaining a hardship through having to pay fares which are unduly large compared with fares for like service from and to other points related to the center of Boston. Through fares, more speedy transit and a common management resulting from savings in operation, will increase the traffic and hence the income. The board states that it by no means follows that these expected advantages to the public and the carriers will be secured at once, but that all experience in the State indicates that the effect of the unification of ownership or operating control of street railways makes for this result. The board advises that the usual provisions for commission regulation and supervision be included in any laws enacted to further this acquisition of control, which is necessarily to be effected through a holding company in view of the provision in the charter of the Boston

Elevated Railway Company which limits it to a 5-cent fare on its lines. The other companies named in the proposed centralization of control are the Boston & Northern, Blue Hill, Boston & Worcester, Old Colony, Lexington & Boston, and Middlesex & Boston street railways. At present the combined gross earnings of these roads are about $23,000,000 per year and the operating expenses $15,000,000. They carry about 460,000,000 revenue passengers per year, and run about 83,000,000 car-miles. The total number of employees is now about 13,000. It is expected that many economies will result from the combination.

It is estimated that the cost of the cross-town tunnel will be about $3,000,000, and its length approximately 3000 ft. The board suggests that its construction is the logical outcome of the entrance of the new Cambridge subway into Park Street. It recognizes that the Boston Elevated Railway Company ought not under present conditions to be called upon to assume large obligations arising from the construction and operation of new elevated structures, subways and tunnels radiating to the suburbs of Boston, but feels that it by no means follows that an extension of its rapid transit system in the heart of the city is undesirable.

The report of the joint board also advises against legislation which would give the West End Street Railway Company an 8 per cent dividend instead of 7 per cent on the second preferred stock of the Boston Elevated, which is to be exchanged for West End common stock in the forthcoming consolidation planned by the two companies. The commission finds that the proposed subways to South Boston, Milton Lower Mills, Sullivan Square, and Chelsea are too costly to consider, and that no station is needed at Castle Street on the Boston Elevated system. It also finds that it would be entirely impracticable to restore the elevated trains to the Tremont Street subway, which is now occupied by surface cars. Regarding the proposed tunnel of the Boston & Eastern Electric Railroad Company under Boston Harbor, the board recommends no legislation until the quadruple commission upon metropolitan improvements has had an opportunity to render its final report to the Legislature of 1911.

Massachusetts Commission News.

The joint board consisting of the Massachusetts Railroad Commission, the Boston Transit Commission, the Metropolitan Park Commission and the Harbor and Land Commission submitted a report to the Legislature of 1910 last week in which the necessity of definite studies of the electrification of the steam railroads at Boston by the companies was emphasized. This report included a general discussion of improvements desirable in the water front, thoroughfares, railroad tunnel possibilities, and docking facilities, as ordered by last year's Legislature. In reference to electrification the board intimates that the time has arrived when the problem must be attacked with serious purpose; that the transportation facilities of the community will be greatly improved by the use of electricity throughout the Boston terminal district, and that the health and comfort of almost every citizen of Greater Boston will be enhanced if the steam locomotive is discarded. The board recognizes the complex nature of the problem of electrifying a great passenger and freight terminal district, but points to the success attained by the New York Central and the New Haven lines in New York City as evidence that successful installations are certain to follow careful consideration of the questions at issue. The economies in fuel obtainable by the electric locomotive are also reviewed, with the statement that energy can probably be furnished at the electric locomotive for half the consumption of fuel per hp-hour that obtains with steam. The board recommends that the Legislature pass a resolution directing the railroads to analyze and report upon the problem by Sept. 1. Sentiment in favor of electrification is rapidly crystallizing in Boston this year, and it is expected that bills to this end will be introduced in the General Court at an early date.

The Massachusetts Gas and Electric Light Commission has transmitted a report to the Legislature recommending that the laws be so revised that gas companies may not engage in the supply of electricity by unanimous consent of their stockholders, but only as otherwise provided in the existing law, and that electricity supply companies shall be authorized to supply gas only in the same manner that gas companies are authorized to supply electricity; that public service corporations be excluded from the provisions of law permitting corporations organized under general laws or created by special charters to extend or remove their business to any other city or town in the Commonwealth.

The board gives its most earnest indorsement to a continuance of the policy of the State in relation to the declaration of dividends by corporations, and believes that experience has demonstrated the wisdom and value of the statute prohibiting electric lighting and other companies of a semi-public character from declaring any stock or scrip dividends, or from dividing the proceeds of the sale of stock or scrip among its stockholders.

The Edison Electric Illuminating Company of Boston has requested the board to authorize it to issue $60,000 in new stock for the purchase of the electric plant and business of the Lexington Gas & Electric Company.

The Massachusetts Railroad and the Boston Transit commissions, sitting as a joint board, sent to the Legislature this week an 80-page report upon Boston transportation matters, which is summarized elsewhere in this issue. The Railroad Commission gave a public hearing on Jan. 10 on the petition of the Selectmen of Hamilton, asking for a fare reduction on the line of the Boston & Northern Street Railway Company within the town. The company argued that the line in question passes through an isolated section of the community; that it was purchased merely as a connecting link on a through route between Beverly and Gloucester; and that if the fare were reduced the patrons of the system elsewhere would have to bear the expense of maintaining the service in this district of Hamilton. The board took the case under advisement.

Wisconsin Commission News.

The Railway Commission, in a decision dated Jan. 6, has ordered the Chicago & Northwestern Railway Company to install a telephone in its station at Fox River which will afford facilities for communication with its agent at that point by its patrons who may desire to avail themselves of such telephonic communication. This decision was rendered in answer to two petitions, one signed by the Burlington, Brighton & Wheatland Telephone Company and the other by 25 of the company's patrons residing in the vicinity of the Fox River station. The testimony showed that the telephone company has over 200 subscribers who reside in the villages and country surrounding the Fox River station. The petitioning telephone company has long-distance connections with the Wisconsin Telephone Company and with the Farmers' Telephone Company, many of whose patrons make use of the Fox River station. The railway company has absolutely no telephonic connection whatever with its depot. The testimony shows that most of the signers of the petition were farmers and business men who transacted considerable business with the Fox River station agent and who are seriously inconvenienced by the lack of a telephonic connection with the station.

The law requires a railroad company to maintain a "station" at every village having a postoffice and a population of 200 or over, and the counsel for the railroad raised the point that, inasmuch as Fox River has a population of only 60 inhabitants, if the commission granted the order as prayed for by the petitioners, the company would be compelled to provide telephonic service at a station which it is not required under the law to maintain. However, the Wisconsin law states that "every railroad company shall furnish reasonably adequate telephonic connections with its office buildings and grounds." The com-

mission has the power, upon complaint, to investigate and remedy any inadequate service, and in this decision they regard every railway station as an "office" and subject to the law as stated above. This decision means that it will practically be necessary for a railroad to install a telephone in each one of its offices, even if the only connection possible is to a rural line.

In a petition signed by 28 residents of Hortonville, it is alleged that the Wisconsin Telephone Company does not furnish its subscribers with a printed schedule of rates and rules; that subscribers have been induced to sign contracts through misrepresentation; that the contract is unnecessarily long, complicated and ambiguous; that the telephone company is, and has been, discriminating against users of business telephones; that the rates charged by the telephone company are excessive.

The evidence shows that the company has complied with the State law which requires a copy of rates and schedules to be kept in a public place and open for inspection.

As to the second allegation, the testimony showed that the misrepresentation complained of consists in agents representing to subscribers that an order issued by the railway commission was responsible for the increase in rates charged. It appears that the whole matter relates to events arising out of changes from grounded to metallic service in which certain representatives of the company apparently thought it easier to shift the burden of an unpopular task upon the commission rather than confess the injustice or discriminatory practice of the past.

As for the third matter in the complaint, the commission has no power to interfere with a contract unless its terms are contrary to good public policy and transgress the statutory provisions relating to service and rates.

The complaint alleging discriminatory service grew partially out of the classification of telephones which are used for business purposes as business telephones, although the use to which they are put and the part of the building in which they are installed would justify only residence rates. The petitioners maintain also that the practice of charging a higher rate for business telephones than is charged for residence telephones is an unjust discrimination.

As this allegation challenges the entire system of classification of telephone subscribers in every exchange in the country, and as this question is of too broad a scope to be decided without a careful special investigation, the commission held in abeyance its decision upon this feature of the case. It may be that the range between business and residence rates is too great and that more classes than now prevail should be created. The rates now charged by the Hortonville Telephone Company are as follows: Rural service, $15 per year; business—single-party line, $2.50 per month; business—four-party line, $2 per month; residence—single-party line, $1.50 per month; residence—four-party line, $1 per month.

The engineers of the commission have put a value of $10,000 upon the exchange and equipment. An examination of the company's accounts shows that the Hortonville exchange has yielded an average return of one-tenth of 1 per cent upon the investment during the last six years. This result was arrived at after a most careful and thorough examination of the accounts and apportionment between exchange and toll business as severely strict as it could be made. Thus the only hope of the petitions for lower rates lies in the possibility of a more economical service which might arise from an improvement in the state of the art. As the telephone company did not enter a counter petition for higher rates, the commission dismissed the case with the exception of the matter of reclassification, which it will treat in detail at some future time.

Canadian Hydroelectric Commission News.

The results of the January civic elections in various Ontario municipalities have shown that voters are still favorable to the supply of electric power through the agency of the commission.

In Port Arthur a by-law authorizing the City Council to execute the agreement with the commission for a supply of electric power was carried, the vote standing 633 for and 318 against. Another by-law providing for the city taking power from the Ontario & Michigan Power Company was defeated by practically the same figures. Application is being made by this company for another injunction to retain the execution of the agreement between the city and the commission.

In Brampton the referendum submitted to the people asking if they were in favor of entering into a contract with the commission for electric power was carried by a vote of three to one; while a by-law providing for the raising of $40,000 for the necessary distribution plant was also carried by nearly as large a majority.

Similarly at Dundas the ratepayers carried a by-law providing for the town taking power from the commission, there being a large majority in favor of the by-law.

Hon. Adam Beck, chairman of the Hydroelectric Commission, expressed himself as particularly gratified with the victory at Port Arthur, resulting in the defeat of Mr. Conmee's offer which, though at a lower rate than that provided in the commission's contract, was only to supply power for the use of the corporation to run its street railway and lighting circuits and did not guarantee any lower rates to the citizens. He stated that the carrying of the hydroelectric by-laws at Brampton will mean the erection of a substation at Port Credit, with lines constructed to Streetsville, Georgetown, New Toronto and the surrounding communities, aggregating a supply of about 2000 hp. The Port Credit station will share the cost of the transmission from Niagara Falls with the substation at Toronto to the extent of 2000 hp, thus reducing the power rate in Toronto by 25 per cent, and a corresponding benefit to the Port Credit station.

Mr. Beck added that the price at which the commission now hoped to be able to supply electric power to the two places would mean the establishment of a large continuous manufacturing district between Toronto and Port Credit.

Under the present arrangements the Hydroelectric Commission will deliver power in Toronto at $18.10 per year per horsepower, and it will be distributed by the city at a minimum of $20 per horse-power per year. The residence lighting rate will be 10 cents per room per month, plus a meter rate of 3 cents per unit. The street-lighting rate has not yet been announced.

New York Public Service Commission News.

At a hearing on the Third Avenue Railroad Company's reorganization plan F. W. Whitridge, receiver of the company, testified before the Public Service Commission, of the First District of New York, that he estimated the replacement value of the property at about $40,000,000 and the proper value from the point of earnings at about $60,000,000. Mr. Whitridge said that at the present time he figured the net earnings of the property at about $2,400,000, which is 4 per cent on the valuation named. Upon this basis he favored the plan of reorganization proposed by the bondholders. Mr. Whitridge believes that the new equipment of the road is adding very much to its earning power and he estimated that only about $1,000,000 would have to be expended for new equipment and extensions within the next three years. He also said that he had made it a practice to settle all damage claims outside of court that were possible and that by doing this he had reduced the damage claims to about 4 per cent of the gross earnings. The commission has rendered no decision in the matter as yet.

The Public Service Commission has issued an order instructing the Interborough Rapid Transit Company to use its side-door cars on express trains all through the day instead of during the rush hours as at present.

In response to a consumer's complaint concerning the quality of gas furnished in Greater New York, Chairman Willcox, of the Public Service Commission, points out that the commission is powerless to take up a complaint against a gas or electric light company unless it is made by 100 consumers or by the Mayor of the city. Mr. Willcox also suggests that the law

should be changed so as to give the commission greater power.

The Public Service Commission of the First District has sent to the Tax Department an estimate that the subways so far constructed in New York have cost the city about $59,206,423. This simply refers to the cost for which corporate stock was issued.

The Public Service Commission, Second District, will hold hearings this week at Buffalo upon the application of Herbert D. Pierce, Howard A. Pierce, Elizabeth Pierce and Laura S. Frank for leave to transfer franchises from the village and town of Hamburg and all of the property used in connection with the Herbert D. Pierce Electric Company to the Howard A. Pierce Electric Light Company, and upon the application of the Howard A. Pierce Electric Light Company for authority to receive a transfer of property from Herbert D. Pierce, Howard A. Pierce, Elizabeth Pierce and Laura S. Frank and to issue stock in payment therefor.

The Public Service Commission, Second District, has decided the cases involving the electric light, gas and railway properties in the city of Port Jervis, which have formed a subject of great interest in that city for some time past. The Port Jervis Electric Light, Power, Gas & Railroad Company which operated the gas and electric plants and a trolley line, because of excessive funded debt and other liabilities and extensive depreciation of the railroad property, found itself unable to comply with an order of the commission requiring that the railroad be put in a condition of safe and satisfactory operation. In consequence of such inability to obey the order of this commission, a mortgage foreclosure suit was instituted by the bondholders, who bought in the property. Two successor corporations were formed, one to take over the lighting property and one to take over the railroad. The commission grants capitalization to the Port Jervis Light & Power Company of $118,000 capital stock and $170,000 bonds, and to the Port Jervis Traction Company of $20,000 capital stock and $70,000 bonds. The stock of each company goes to the bondholders as the purchase price of the property. The bonds to be issued by each company are solely for improvements necessary to put the properties in proper condition, except that the light and power company bonds include the taking over by that company of the traction company bonds. This is because the railway bonds are likely to sell at a large discount, while the light and power bonds are to bring at least 90 per cent of face value. The combined capital thus fixed for the new companies is based upon actual value and is a reduction of $357,000 from the capitalization of the old company, which amounted to $735,000. In an opinion written by Commissioner Martin S. Decker, the commission holds that the successor corporations are as such entitled to take over the properties and to issue capital stock and bonds upon a fair basis.

The decision also disposes of the application of C. F. Wright and others, who desired to form a corporation to furnish gas and electricity in Port Jervis and to build and operate a trolley line in that city, as well as to develop a water-power at Mongaup Falls, 14 miles from Port Jervis, manufacture electricity at that point and bring it by transmission line to Port Jervis. These petitioners also proposed to build an electric railway from Port Jervis to Milford, Pa. The object of this proposed corporation was to supplant the old lighting and railroad company and its successor corporations in Port Jervis. The decision declares that as the successor companies are in possession of property rights that cannot be denied, this object cannot be attained by order of the commission. If the new company were authorized by the commission to produce and supply gas and electricity to residents in Port Jervis, both companies would probably become bankrupt in a short time and one would without question, with probable resulting consolidation and unnecessary increase of capitalization on that account. As to the street railway, the new traction company in possession cannot be compelled by the city or by the commission to vacate the streets, there is no suggestion that another road could be operated in the same streets, no franchise for a road in other streets has been granted by the city and if it had, proof must be submitted that it could be operated without continual loss, and with good service by the present line it seems no such proof could be presented.

The opinion of Commissioner Decker states the service of the old company was so poor and the rights and proper interests of the people of Port Jervis were disregarded to such an extent, that if the Wright petition had been presented before the sale on foreclosure, such petition would have been granted; but the situation in its legal aspect has been so changed by the sale and formation of companies to take over both the lighting and railway properties and operate them under fair capitalization fixed by the commission, that a just basis for approving the exercise by the proposed new company of the new franchises in Port Jervis is lacking at this time. The commission says now definitely that upon showing serious continuing disregard by the new lighting company of its obligations to the public, it may expect nothing less than prompt recognition of its delinquencies and drastic action through approval of the exercise of new franchises by a competing company. The petitioners Wright and others are left free to present the application at any time for a corporation to develop the Mongaup River power and build an electrical transmission line to Port Jervis. The city is stated to have the right to purchase light and power for municipal purposes from any source.

Worcester Motor-Service Situation.

In his inaugural address last week Mayor James Logan, of Worcester, Mass., reviewed the power situation in the city at some length, and commented upon the era of business expansion upon which the city is entering. He stated that cheap energy would be an important factor in the future of the city, and commented upon the recent efforts of the Worcester Electric Light Company to increase its motor load, arguing that such a policy could not but be a public benefit. In reference to the recent decision of the Massachusetts Gas and Electric Light Commission restricting the sale of energy in Worcester by the Connecticut River Transmission Company to customers of 300-hp installations and over, Mayor Logan voiced his regret that the board had not found it possible to permit the water-power company to supply energy to smaller users. He recognized that the local company has a monopoly of the small motor service business, under State control, and stated that the recent accession of several new directors of high business standing in Worcester should be advantageous to the electric light company in its relations with the public and its customers. In conclusion, the Mayor stated that he is negotiating with the company for further reductions in its rates for street-lighting and commercial service, although no agreement as to this has yet been reached.

Within the past three or four months the Worcester Electric Light Company has made a special effort to increase its motor load, and on Sept. 1 issued a schedule of rates which compares favorably with the charges of any similarly situated company in the East. A motor solicitor has been at work among merchants and factory owners, and several new motor loads have been secured. In recognition of the possibilities of modern power-plant economy, the company is rapidly shaping plans for a new station at Curtis Pond, in the southern portion of the city. It has concluded an agreement with the Connecticut River Transmission Company whereby the latter is to use portions of the former's conduit system in distributing energy to large motor users. With the establishment of the new generating station it is expected that an impetus will be given in the direction of establishing more industrial plants in the southern section of the city. At an expense of over $40,000 the company recently changed its entire street-lighting system from open arcs to 4-amp magnetite lamps, and it has steadily pushed the installation of underground conduits until at present no city in Massachusetts, outside of Boston, has a comparable length of wire below the surface of the streets. In well-informed circles there is a general feeling that the recent decision of the

Gas and Electric Light Commission conserving the small motor service business in the hands of the established company was in harmony with the broader economic view of engineering costs and possibilities. It is not yet known whether the company will consent to any further rate reductions at this time, in view of the substantial cuts which it made four months ago.

Power Plant Economy.

At the December meeting of the Boston section of the American Institute of Electrical Engineers the speakers were Mr. Paul Winsor, chief engineer of motive power and rolling stock of the Boston Elevated Railway Company, and Prof. Ira N. Hollis, of Harvard University. Mr. Winsor discussed the effect of improvements in old equipment on maintenance, and Professor Hollis took up the question of power-plant economy on a broad basis.

After describing the system of keeping record of car defects on the Boston Elevated Railway Company's lines, Mr. Winsor reviewed various improvements which the company has made in recent years in its railway motors, brakeshoes, controlling equipment and power-station machinery. Some of the old direct-current generators of the company have been thoroughly overhauled with excellent results. The brush holders have been redesigned, the compounding checked up and the setting of the brushes tested on the basis of voltage distribution around the commutator. It was found undesirable to set the brushes of some machines on the diameter, and in some cases the brushes could not be placed an equal number of bars apart. The equalizing was also gone over, and as a result the machines operate more in harmony during this winter than previously. As a result of the system of keeping watch of car defects, these have been decreased in the past three years from 50 to 17 per day. By slotting the commutators of the railway motors, the company has lengthened the life materially, from nine months to four or five years or more. Part of the increased life, however, is due to the selection of better brushes and also to turning down the commutators oftener. Notable success in the reduction of motor troubles and increase of efficiency of car equipment working was due to the use of a recording ammeter on the car circuit, enabling the resistances to be adjusted to better advantage. Mr. Winsor closed with a short talk upon the benefits of the monthly meetings of the car-house foremen in Boston.

Professor Hollis emphasized the difficulty of foretelling what types of station equipment are most likely to survive in the present competition of motive powers. He considered it probable that each type of machine will find its special field. The basis of judgment on any power station problem must be dollars and cents. Whether one machine is a better one from the thermodynamic point of view is not the question. The final issue is the number of cents that a hp-hour or a kw-hour will cost in a given situation. Reliability is, after all, a question of dollars and cents. In order to make a station reliable one must pay more money for the apparatus or have additional elements to make up the efficiency of the station. Professor Hollis said that when he came to Harvard College a noted consulting engineer told him that from a set of bids on machinery it is best to take the highest as the one most liable to give the lowest running expense.

The cost of producing energy is fairly divided into a number of elements, such as interest on the investment, superintendence, repairs, depreciation, coal, etc., and finally certain miscellaneous elements like oil, water, waste, etc. In general a plant operates most economically when delivering a constant power, whether it is a steam engine, gas, or turbine plant. The most unfavorable condition for economy is where a plant is operated for only short periods, where a large amount of equipment must be kept in readiness for service. In general the larger first cost pays best in the long run, as do high-class superintendence and labor. These will in general reduce the repairs and depreciation, so that the first three elements in running a station should not be kept down to the lowest notch of expense for fear of increasing other things beyond proper limits.

Professor Hollis stated that in investigating the economy of the ordinary power station there are three elements to be considered: first, the standby losses introduced by the machinery; second, arrangement of some nature for the storage of energy; and third, a fairly constant heat efficiency in the face of a varying load. Every station may be judged on the basis of these three things. The standby losses exist in every station where there are boilers. That is a steady loss, for every boiler is using up energy through radiation, leakage, etc., and this loss means coal consumption. The speaker said that he had tested six 1000-hp boilers some years ago and found that while these were of the internal type, with no loss due to brickwork, there was a large radiation from the shells. To keep up steam pressure on each of the boilers required about 1 ton of coal per day of 24 hours. The boilers were in marine service, and it was estimated that even if the ship did not move at all, the entire supply of coal in the bunkers would be used up in from 130 to 140 days. The same thing is true of every station, and one of the chief sources of station economy is to cut down the boiler standby losses to the minimum. The same point applies to gas-power plants. In the producer there is a precisely parallel case, with the same kind of losses, and any station which requires a large number of producers to remain in readiness for service while the engines themselves are in operation for only comparatively short periods will in time be a very expensive station to maintain. A gas engine may easily develop a brake-horse-power on 1.25 lb. of coal per hour, and yet be inferior to a steam engine simply because the gas engine was operated 8 to 10 hours per day and the producers had to be kept ready for service, so that the losses in the night in the gas plant may exceed those in the steam installation.

In discussing the influence of varying loads upon steam turbine economy, Professor Hollis said that a recent test for a 5000-kw turbo-alternator showed a steam consumption of 20 lb. per kw-hour between 2500 kw and 3000 kw. At 4500 kw the consumption dropped to 17 lb., and above 6000 kw the consumption was 20 lb. again. Beyond the 6500-kw point, the machine was inefficient in the extreme. Professor Hollis then reviewed the sphere of the exhaust steam turbine, and cited the good results obtained by the Interborough Rapid Transit Company at the Fifty-ninth Street station in New York with this type of equipment. In closing, Professor Hollis emphasized the desirability of simplicity in station design, and touched upon the difficulties of securing experienced engineers capable of handling varieties of machinery under the same roof.

CURRENT NEWS AND NOTES.

Swiss Electrical Journals.—According to a consular report, there are 16 electrical journals in Switzerland, not including periodicals devoted to the telegraph or telephone.

Baltimore-Chicago Wireless.—Wireless telegraph messages were exchanged between Baltimore and Chicago for the first time on Jan. 5.

Natural Gas for New York.—According to reports from Pittsburgh, the Standard Oil Company is planning to expend $15,000,000 for a 20-in. main from the gas fields of West Virginia and Western Pennsylvania to New York City, where the gas will be sold for 50 cents per 1000 cu. ft.

Industrial Special Libraries.—Mr. Guy E. Marion presented an interesting paper before a recent meeting of the American Chemical Society describing in detail a comprehensive method for the classification and filing of books, pamphlets, trade catalogs, periodicals and samples, as applied in the Arthur D. Little Laboratory.

Meter Tests.—Of 6312 meters tested in November, 1909, according to the reports filed with the Public Service Commission, Second District, 4076 were tested on the premises and 2236 at plants. Of the total number 570, or 9.04 per cent, were fast; 4730, or 74.93 per cent, were accurate, and 1012, or 16.03 per cent, were slow.

Electricity from the Sun.—Reports from Burlington, Vt., state that Mr. George H. Cove has applied the thermopile principle for converting the energy received directly from the sun into electricity for charging storage batteries. No information has been given out concerning the details of the thermopiles or of the regulating devices in the charging circuit.

Wireless Transmission of Music.—Dr. Lee de Forest announces that he has arranged with the Metropolitan Opera Company to conduct experiments relating to the transmission of music by wireless telephony from the opera house in New York to certain receiving stations. Two special masts have been erected at the opera house and the first experiments will be conducted during the present week.

Sub-Sidewalk Space for Electric Conductors.—It is proposed that the city of Chicago take advantage of the recent court decision confirming the city's right to sub-sidewalk space and adopt a plan to secure the eventual location of all electric wires, water pipes, gas mains and sewers in this space. A change of this sort would impose a great burden on the public-service companies, but if adopted would prevent the tearing up of streets to give access to varied utilities. The City Council committee on gas, oil and electric light has the suggestion under consideration.

Telephones in Turkey.—A dispatch from Constantinople states that an Anglo-American syndicate, having obtained a telephone concession from the Porte for the Turkish capital, a French company which also sought the concession has, with the co-operation of the Eastern European Cable Company, addressed a protest to the Turkish Parliament. The protest complains that favoritism was shown the Anglo-American company and demands that the concession be annulled. The French company wants the matter settled by the courts and proposes to put in a claim for 2,000,000 francs damages.

Tuning in Wireless Telegraphy.—In commenting upon the interference in wireless telegraphy, which has been brought prominently forward by the Roberts bill suggesting the appointment of a wireless board, the New York *Times* asks concerning the promised "tuning" systems. The editorial writer states: "Dozens of eminent electricians have confidently asserted the practicability of that, but apparently not one of them has even begun to do it, and, so far as present indications go, none of them ever will. Lack of some such device is causing grave trouble for the wireless men already, and it threatens to become intolerable if their numbers increase much more."

Demonstration of Gyroscope Monorail Car.—During the present week a 2.5-ton four-passenger Scherl gyroscope monorail car has been exhibited in operation on an elliptical track at the Clermont Skating Rink in Brooklyn. The car is provided with two gyroscopes revolving in opposite directions in vacuums at about 8000 r.p.m. The car maintains its balance under all conditions of loading and speed, the application of gravitational and rotative forces being kept in line with the rail automatically, quite independent of any unsymmetrical loading or variation in speed around curves. The advantages of this extraordinary combination from the standpoint of tractive economy are not apparent.

Edison on Life Problems.—Mr. Thomas A. Edison is quoted in the last issue of the *Independent* as follows: "Communication with other worlds has been suggested. I think we had better stick to this world and find out something about it before we call up our neighbors. They might make us ashamed of ourselves. Not individualism, but social labor will dominate the future. Industry will constantly become more social and interdependent. There will be no manual labor in the factories of the future. The men in them will be merely superintendents watching the machinery to see that it works right. Less and less man will be used as an engine or as a horse, and his brain will be employed to benefit himself and his fellows."

Weather Reports by Wireless.—Storm warnings are now being transmitted along the coast and to ships at sea through an arrangement between the telegraph companies and the naval wireless station at Newport. Immediately after a warning of bad weather off the coast is sent to the telegraph companies by the United States Weather Bureau, the Government wireless operator at Newport is notified. A moment later the warning to mariners goes out through the air. Mr. Willis L. Moore, chief of the bureau, has called attention to the fact that when all vessels are equipped with instruments and are under international agreement that shall compel each vesel to receive and transmit observations from other vessels, it will be possible to make a weather map for commercial use so that vessels can avoid storms.

Illuminating Engineering.—The New York Section of the Illuminating Engineering Society will hold a meeting on Jan. 20. A paper entitled "Bowling Alley Lighting" will be presented by Mr. Thomas W. Rolph, and one entitled "Selling Electric Light" will be read by Mr. T. I. Jones. The latter will deal with the sales department organization and methods employed by the principal electric lighting companies in the United States, with particular reference to Greater New York. It will relate to the purely commercial side of the business, describing various forms of commercial lighting installations, canvassing methods and results, forms of contracts and types of illuminants used and general experience in the handling of the public. The paper will be illustrated by lantern slides.

Independence of Commercial Cable.—At a dinner given by him to 200 officers and staff, in New York, of the Commercial Cable Company, on Jan. 8, Mr. Clarence H. Mackay, the president, stated that his company would remain independent and renew its efforts in view of the recent combination between certain telephone and telegraph interests. At the dinner, which commemorated the twenty-fifth anniversary of the corporation, the most interesting favor was a small piece of the Commercial Company's original cable, which was recovered recently from great depths in the Atlantic after having been submerged 25 years. Although the cable had been lying in water under great pressure for so many years very little deterioration had taken place. The sheathing wires are almost as sound as on the day the cable was laid.

Production of Tungsten.—The production in the United States in 1909 of tungsten concentrates reckoned at 60 per cent of tungstic trioxide was 1958 short tons, valued at $746,130, according to figures compiled by Mr. F. L. Hess, of the United States Geological Survey, from returns received from producers. These figures represent the exact production for the first 11 months of the year plus the estimated production in December. Of this amount Boulder County, Colorado, produced 1401 tons, valued at $550,280. In 1908 the total production was 671 short tons, valued at $229,955, and there was, therefore, an increase in 1909 of 1287 tons in output and of $516,175 in value, or about 200 per cent. The greater part of the tungsten mined is used for the production of tungsten irons. A few carloads would supply all of the demand for tungsten lamp filaments.

Sons of Jove at Chicago Electrical Show.—A rejuvenation of the Sons of Jove will be held on the evening of Friday, Jan. 21, at the Coliseum, Chicago, during the Electrical Show. A large class of candidates will be initiated, and luncheon will be served.

Gyroscope.—At a meeting of the New York Electrical Society, to be held on Jan. 27, Prof. W. S. Franklin, of Lehigh University, will deliver a lecture entitled "The Practical Bearing of the Gyroscope." New applications of the gyroscope principle to railroad and aeronautic uses will be discussed and illustrated.

Electric Vehicles in New York.—In an editorial in the issue of Jan. 6 (page 11), a statement as to the number of electric vehicles in use in New York should apply only to commercial vehicles or electric power wagons. Of this specific class there are about 900 in New York, or nearly half of the entire number in the country.

Appointment of Dr. E. W. Bemis.—Dr. E. W. Bemis was appointed by Mayor Gaynor, of New York City, deputy commissioner of Water Supply, Gas and Electricity, not commissioner in charge as erroneously stated in our issue of last week. Mr. Henry S. Thompson, formerly with the Thompson-Starrett Company, building contractors, was appointed commissioner of the department. Mr. Thompson was superintendent of city buildings from May, 1903, to 1907, and for about a year following was Commissioner of Public Works, which position he resigned in February, 1908.

American Electric Light Plant in Manchuria.—Vice-Consul-General Frederick D. Cloud, of Mukden, reports that through the initiative of that consulate an American company is arranging with the Chinese authorities to install an electric light plant at Changchun (Kuanchengtzu), the junction city of the Japanese and Russian railway lines. The initial cost of the plant will be approximately 125,000 taels (about $90,000). Most of the material for this installation will be of American manufacture and the installation of the plant will be under the supervision of an American engineer.

Electric Club Smoker.—Two hundred and thirty-two members of the Electric Club of Chicago and guests enjoyed a vaudeville entertainment followed by a Dutch supper at the Automobile Club on the evening of Jan. 7. The party was a jolly one and the gentlemen present were not only entertained by the efforts of the professional performers, but enjoyed the opportunity of meeting one another socially and informally to the fullest extent. A number of out-of-town electrical men were present. The affair was in charge of an entertainment committee consisting of Messrs. George H. Porter, R. M. Van Vleet, W. S. Taussig and others.

Public Lectures on Electricity.—The Department of Education of the City of New York announces a course of public lectures on electricity to be delivered in the assembly hall of the Young Men's Institute, 222 Bowery, Borough of Manhattan, on the Wednesday evenings of January and February. The lectures will be illustrated by experiments, working apparatus and stereopticon views. "Electric Railways" is the subject of the lecture for Jan. 19. The subjects of subsequent lectures in the order of their delivery are "Electric Heating and Welding," "Incandescent Electric Lighting," "Arc, Vapor and Non-Vacuum Lamps," "The Telephone and Telegraph," and "Wireless Telephone and Telegraph Systems." The lecturer is Mr. T. I. Jones.

N. E. L. A. Membership.—The National Electric Light Association, whose rapid growth in membership we have noted recently, has again been making advances, and began the new year with a total of 4500. This is a gain of 1200 members in about three months, which is believed to constitute "the record" in technical or engineering bodies, and indicates what the powers of expansion are within this useful society. Chairman H. H. Scott, of the membership committee, expresses the confident belief that the number can easily be carried to 7500, and that even so high a figure may be reached during the current year, possibly by the annual convention, which will mark the twenty-fifth anniversary of the association. The new membership campaign is being directed particularly on operating central station companies, many of which do not yet realize the benefits that can come to them from sharing in the association work.

Entertainment at Coming Wisconsin Convention.—Preparations are under way to make the convention of the Wisconsin Electrical Association at Milwaukee on Jan. 19 and 20 attractive from the point of view of social entertainment. The matter is in charge of an exhibitors' organization connected with the association, and the exhibitors are represented by a committee consisting of Messrs. H. P. Andrae, of Julius Andrae & Sons Company, Milwaukee; F. G. Bolles, of Allis-Chalmers Company, Milwaukee, and W. R. Pinckard, of the Westinghouse Electric & Manufacturing Company, Chicago. This committee has arranged for a complimentary "good-fellowship" entertainment to be held on Wednesday, Jan. 19, from 8 p. m. to 12 p. m., at the fine hall of the Elks Club in Milwaukee. There will be a smoker and Dutch lunch, and professional entertainers will lend their aid, while good musicians will be present to lead in the singing, in which all are expected to join.

Electromagnetism Explained.—In a circular including a weather forecast for 1911 (the forecast for 1910 being given in another circular), "d. a. n. grover, of kansas city," who has apparently an antipathy to the use of capital letters, gives the following explanation of "so-called electromagnetism." "as we pile up a number of coins into a column, let us think of a trillion solar systems arranged side by side, thereby forming a long wire-like column with the north poles of the sun and planets of every system opposite the south poles of the sun and planets of the next adjoining system and so on throughout the length of the entire column. thus we have a long wire like column of solar systems, with each and every one revolving—say from west to east, that is, all of them rotating on axes and moving in orbits in the same general direction. the thickness of this immense wire-like column would be the diameter of a solar system, or greater than the diameter of the orbit of neptune and the length of such a wire of systems would be the aggregation of a trillion solar systems placed side by side like coins in a stack of coins. if we conceive of the ends of this immense wire-like column of systems brought around and joined to form a circle, with all the systems revolving toward the center and downward through the center of such a circle, we have, in a rough way, a visible illustration of the magnet-principle. the upper side of this horizontal circle is called 'positive,' the under side of the circle, or so-called magnet, is called 'negative.' systems of matter made up of systems whose sizes, or whose members and orbits approximate the size of the members and orbits of these solar systems will also revolve and move toward the center of this circle and downward, if placed above and near this circle of revolving systems; because the members of the system of such matter would find, of all the directions of the universe, that they would meet with less resistance, or encounter less universal repulsion, by following the receding members of the circular 'magnet' that are with-drawing their individual amounts of universal repulsion as they recede toward the center and downward through the 'magnet.' under the circle of revolving systems is called 'negative.' if the same systems of matter be placed under the 'magnet,' or circle of systems they will be repelled downward and in directions away from the center and toward the circumference of the circular 'magnet' by the approaching members of the solar systems of the 'magnet' as they come down through the center and move outward in their orbits toward the circumference of the 'circular magnet.'"

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Submarine Energy Transmission between Sweden and Denmark.—The Government of Denmark is arranging to place submarine cables under the Sund, which separates Helsingborg, Sweden, from Helsingor, Denmark, by about three miles, for the purpose of transmitting energy from a 325-ft. waterfall situated about 1.25 miles from the mouth of the Lagu in Sweden.

A. I. E. E. Meeting.—At a meeting of the American Institute of Electrical Engineers to be held on Jan. 14, in the Engineering Societies Building, New York, a paper entitled "The Space Economy of the Single-Phase Series Motor" will be presented by Prof. W. S. Franklin and Mr. Stanley S. Seyfert, of Lehigh University. This meeting will be under the auspices of the railway committee of the Institute.

Fuel Oil.—In voicing its objection to the order of the Public Service Commission requiring the use of oil-burning locomotives in the Adirondack forests during certain months, the New York Central & Hudson River Railroad Company claimed that 170 gal. of oil are required to equal in fuel one ton of bituminous coal, and that oil-burning locomotives cost twice as much to operate as do coal-burning locomotives. The company proposes to continue the use of the latter locomotives and to clear its right-of-way for 100 ft. on either side of the roadbed.

Municipal Railway for San Francisco.—After declaring against municipally owned and operated street railways three times in five years, voters of San Francisco, at a special bond election held on Dec. 30, registered their will decisively in favor of the project. The city owns a cable line extending from Market Street, out Geary Street, to Golden Gate Park, the system being leased to private capital. The proposal before the votors was to issue $2,020,000 in bonds to reconstruct the road and operate it under supervision of city officials. The issue had twice been defeated previously.

Wood Preservers' Convention.—The annual meeting of the Wood Preservers' Association will be held at the Auditorium Hotel, Chicago, on Jan. 18 to 20. A large number of papers will be presented, and one of them, by Mr. Andrew Gibson, superintendent of timber preservation for the Northern Pacific Railway, will treat of "Economics of Cables, Electricity or Locomotives in Moving Materials at the Plant." The president of the association is Mr. Walter Buehler, consulting engineer of the Kettle River Quarries Company, of St. Louis, and the association's secretary is Mr. C. W. Berry, of Laramie, Wyo.

Straight 5-Cent Fare Upheld.—In an opinion rendered on Jan. 3 by Justice Day, the Supreme Court of the United States held to be invalid an ordinance adopted by the City Council of the city of Minneapolis, Minn., in 1907, requiring the Minneapolis Street Railway Company to sell six tickets for 25 cents. The company fought the ordinance on the ground that it was a violation of the contract implied in its charter, which, issued in 1873, was to run for 50 years, and which authorized a charge of 5 cents for each ride. The United States Circuit Court for the District of Minnesota declared against the ordinance, and Justice Day's decision sustained that finding.

Subway for Toronto.—The ratepayers of Toronto, at the municipal elections on Jan. 1, by a vote of 19,268 as against 10,697, decided in favor of the city corporation making application to the Ontario Legislature for the necessary authority to construct and operate a system of municipal subway and surface railway lines in order to furnish rapid transportation to and from the downtown district to the citizens residing in the outlying portions of the city. While the tube railway referendum was so overwhelmingly carried, the father of the project, Controller H. C. Hocken, was defeated by a majority of over 4000 in the contest for the Mayoralty.

Water-Power in the Northwest.—Mr. John L. Wilson, of Seattle, Wash., formerly United States Senator from Washington, is credited with the statement that in the watershed of the Columbia River there is known to exist about one-third of the entire water-power of the country. On the Des Chutes River alone, Mr. Wilson is reported to have said, water-power is being developed to supply the needs of 600,000 people, "and it is only a question of time when every wheel in the northwestern country will be turned by electricity." The glaciers on Mount Ranier and other mountains supply a valuable reserve for hydroelectric plants. The action of the sun on these masses of snow and ice supplies water for the intakes of the water-power plants at the time when it is most needed.

Chicago Maximum Load.—The maximum load of the Commonwealth Edison Company, Chicago, for 1909 occurred on Dec. 6 and reached 158,090 kw, which was also the maximum load in the company's history. The figure, which shows an increase of 34 per cent over last year, was awaited with interest by participants in a pool made up of contributions of 50 cents accompanying each guess as to what the maximum would be. The pool was to be divided into prizes of 50, 30 and 20 per cent for the three most nearly correct guesses. There were 85 guesses, ranging from 145,000 kw to 182,000 kw. Mr. J. H. Goehst, superintendent of construction, and Mr. W. L. Abbott, chief operating engineer, each guessed 158,000 kw, and shared the first and second prizes, each receiving $17. The third prize, which paid $8.50, went to Mr. A. P. Thoms, load dispatcher, whose guess was 158,240 kw.

High-Power Locomotive Headlights.—After a thorough investigation and numerous conferences with railroad men, the Indiana Railroad Commission has issued an order to all of the railroads in the State requiring that all locomotives used for pasenger and freight service shall be equipped with headlight lamps of 1500 cp. The order does not specify that the lamp shall be electric or acetylene. During the investigation experiments with oil and electric headlights were made in the laboratory of Purdue University. While railroad men with few exceptions opposed high-power headlights, electric traction motormen were practically unanimous as to the advantages of high-candle-power over the oil lamp. About 4000 locomotives come under the order, of which one-third are to be equipped by Jan. 1, 1911, and the remainder by July 1, 1911.

Mechanical Engineers' Students' Section.—The senior mechanical engineers of the University of Wisconsin have recently organized a student section under the rules laid down by the American Society of Mechanical Engineers. The name of the organization is the Wisconsin University Student Section of the American Society of Mechanical Engineers. The section was organized in the early part of December of the year 1909, and all men in the university interested in engineering are eligible for membership. The *Journal* of the society is supplied to all student members at a nominal cost. The purpose of the section is to review articles published in the *Journal* and to obtain prominent engineers to speak before the members as often as possible. The meeting of the section is the third Thursday of the month. Prof. C. C. Thomas was elected honorary chairman, and the following are the student officers: Mr. R. N. Trane, chairman; Mr. E. L. Kastler, vice-chairman; Mr. G. A. Glick, secretary; Mr. J. S. Langwill, assistant secretary; Mr. R. A. Reudebusch, treasurer. The section will have its first regular meeting Thursday, Jan. 13, when it will be addressed by Dean Goss, of Purdue University. The section enjoys a membership of 38 students, besides several members of the A. S. M. E. who are honorary members.

STEPNEY BOROUGH CENTRAL STATION.

A Typical Modern British Generating Installation Under Municipal Control.

THE new generating station of the Stepney Borough Council at Blyth's Wharf, Limehouse, London, England, does not differ exceedingly from other modern generating stations, although there are certain features in which a slightly new departure has been made.

The facilities as regard the supply of electrical energy for lamps and motors have been available in Stepney for nearly 10 years, the service having commenced Dec. 16, 1899. The station at that time was under the control of the late Whitechapel Board of Works, but their order, and also the provisional orders obtained by the Limehouse Board of Works and the Mile End Old Town and St. George's-in-the-East Vestries were taken over by the Stepney Borough Council, on the formation of the latter. The original station, which was designed by Mr. Arthur Wright and is still working, is situated in Osborn Street, Whitechapel. It was designed to supply energy only to the area controlled by the Whitechapel Board of Works, and the additions to the district naturally soon made it necessary to provide additional apparatus in this station. Extensions have in fact been made from time to time as they became necessary, with the result that the present Osborn Street station now occupies the whole space available on that site, and the equipment therein has to be fully employed, and is even overloaded during the winter's peak.

That such a state of things would soon come to pass was recognized by the Stepney Council as long ago as 1903, when a site known as Blyth's Wharf was purchased on the river side at Limehouse. About that time, however, the uncertainty engendered by the promotion of various London power schemes made the erection of a new station a somewhat speculative matter, and for this reason building was delayed. It became evident, however, that no power supply scheme for London, even if sanctioned by Parliament directly, could be placed in service sufficiently soon to help Stepney to meet the increasing demands for electrical energy which were being made on its resources. The Borough Council, therefore, instructed Mr. W. C. P. Tapper, the borough electrical engineer and manager, to report on the proposed Blyth's Wharf scheme. His report having been approved, specifications and plans were immediately put in hand, and the equipment was installed without delay.

GENERATING STATION.

The new Blyth's Wharf Station of the Stepney Borough Council has been primarily designed for the supply of high-tension, three-phase energy. The old station of the Council at Osborn Street, Stepney, supplies energy directly to the network on the three-wire, continuous-current system with 480 volts across the outers. The scheme which Mr. Tapper has in view is to transfer gradually the turbine-driven generating plant from the old station to the new. As will be seen later, one generating set has already been transferred from Osborn Street to Blyth's Wharf and another similar set will also shortly be transferred in the same way. In fact, the turbines at Osborn Street were installed there temporarily on the advice of Mr. Arthur Wright, the then consulting engineer to the Council, with the object of ultimate removal to a new station. The space thus made available at Osborn Street will be used for the installation of motor converters for reducing and converting high-tension current from Blyth's Wharf before distributing it to the network. Blyth's Wharf, however, will not be solely a high-tension station, for the consumers in its immediate vicinity will still be supplied with energy directly by means of continuous-current machines.

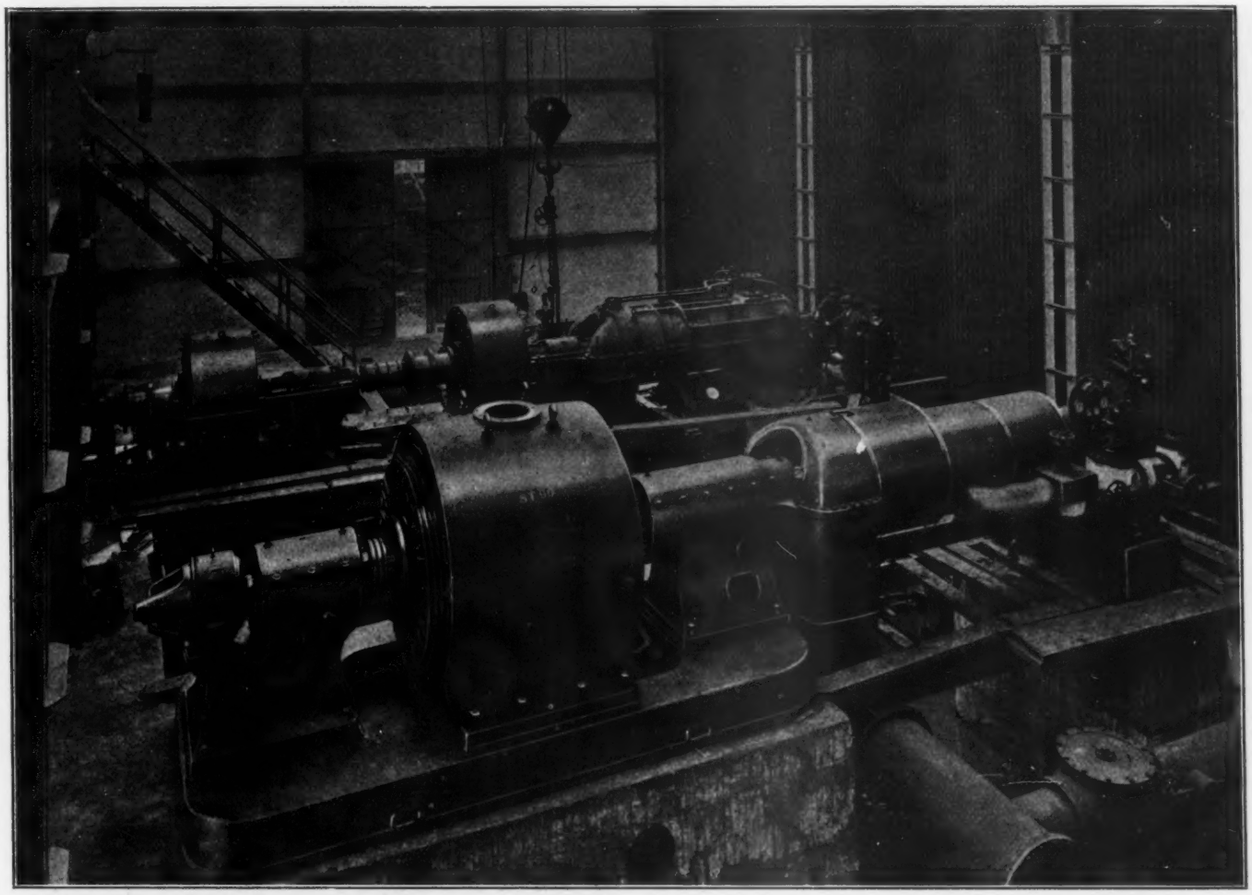

Fig. 1—Interior of Stepney Borough Station, Showing Turbo-Generators During Installation.

The site for the new station has been admirably chosen. Al-

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though the wharf acquired on the banks of the Thames at Limehouse is separated from the station itself by a road, arrangements have been made for the mechanical transport of the coal directly from the barges into the station, while in a similar way ashes will be transferred directly from the station into the waiting barges. It has also been possible to use the river for the circulating water and hence the turbines installed can be worked under the best possible conditions, while all of the energy required will be generated at the lowest possible cost.

The buildings themselves at this new station require a word of mention, although it would be undesirable to describe them in detail. It may be said, however, that they mark a distinct innovation in central-station work in London, for they consist of a steel structure with reinforced concrete walls. As regards cost, this method has much to commend it, the amount being only $15 per kilowatt for the buildings at Blyth's Wharf. As to the architectural features, the station is plain and homely in appearance, but is in keeping with its surroundings. The south walls of the building are of a permanent nature, but the north walls are temporary, so that when necessary they can be taken down and the building extended to make room for more apparatus. The partition between the engine-room and boiler house is of corrugated iron. The outside walls of the engine-room and boiler house are, however, permanent like the south walls. The boiler house and engine-room are respectively 63 ft. wide by 91 ft. long and 67 ft. wide by 91 ft. long.

COAL-HANDLING DEVICES.

As mentioned above, the coal and ashes in their transit between the wharf and the station have to pass across a road.

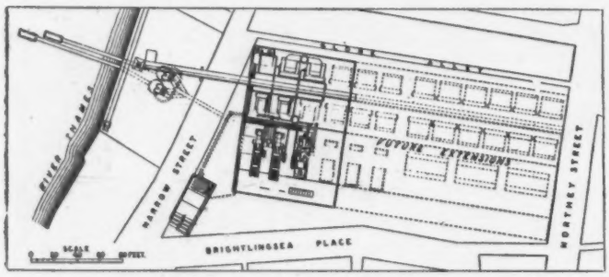


Fig. 2—Plan of Station Apparatus.

The conveyor to be used for this purpose has not yet been installed, but it will pass eventually through the opening which is noticeable on the top left hand of the view in Fig. 3, so that it is, as will be seen, well out of the way. The conveyor on its way from the wharf bringing in the coal passes along the tops of the coal bunkers, deposits its load, moves along to the far end of the boiler house, and then drops down under the boilers. Here it picks up the ashes, and then passing up the other wall of the boiler house, returns to the wharf the way it came. Sufficient room is provided for coal-storage purposes, the bunkers installed at present having a capacity of 1000 tons.

BOILERS.

At the present time three boilers are installed at the Blyth's Wharf station. These are of the marine type, one of which is capable of evaporating 22,000 lb. of water per hour, and the other two 11,000 lb. per hour. Space is provided in the station for four more similar boilers. The large boiler is fitted with underfeed stokers and forced draught apparatus, and the smaller ones with chain-grate stokers and the Pratt patent system of induced draught. The draught in both cases is provided by means of electric fans installed under the boilers, while the Pratt system of induced draught also makes it necessary to have the peculiar shaped chimneys, which may be seen in the photograph. In thus installing both induced and forced draught, Mr. Tapper has made it possible for very interesting tests on the relative efficiency of these two systems to be carried out. A view of the interior of the boiler house is given in Fig. 4.

AUXILIARIES.

As regards the auxiliary plant for steam raising purposes, a Weir patent boiler feed pump is provided, having a capacity of 10,000 gal. per hour. This pump is of the two-unit type, and is so arranged that it can be run compound or be split up into two sections as required for the best economy. The storage

Fig. 3—General View of Station, Showing Provision for Coal-Handling Equipment.

tanks from which the make-up water is supplied are placed in a separate building, and are capable of storing 40,000 gal. In connection with this plant an Archbutt-Deeley water softener is provided.

GENERATING EQUIPMENT.

There are at present installed in the engine-room two turbine sets. One of these is a Willans-Parsons-Peebles turbo-generator, having a rating of 2000 kva. From this is obtained three-phase alternating current at a pressure of 6600 volts, which will be transmitted to the Osborn Street station for conversion to direct current, and thereby supply the demands of the district in the neighborhood of that station. The other set, which was originally at the Osborn Street station, consists of a 1000-kw Parsons turbine, coupled to two generators in tandem. This turbine can either supply energy to the continuous current, three-wire network or can provide low-tension, three-phase current at a pressure of 140 volts. Transformers have been provided in the basement of the station for stepping up the voltage from

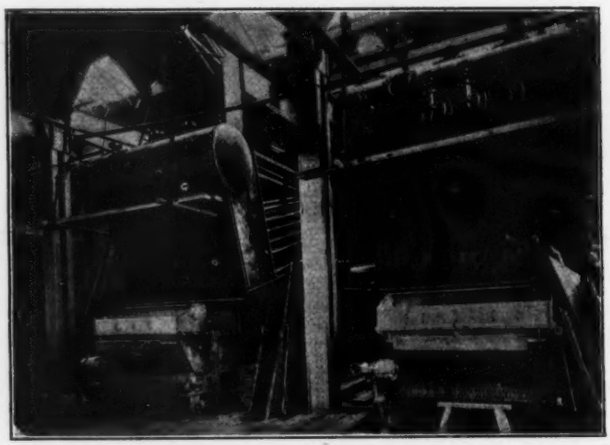


Fig. 4—Boiler Installation.

this machine for the transmission of energy to the Osborn Street works, if necessary. Both turbines are completely equipped with the usual condensers and other auxiliary apparatus. Contraflo condensers and air pumps, supplied by Messrs. Willans & Robinson, are used, an individual set to each generator. These pumps are motor driven, and in fact

motors have been used throughout the condensing and circulating plant. The motors for driving the air pumps were built by Bruce, Peebles & Company, of Edinburgh.

As mentioned above, the circulating water for condensing purposes is obtained from the river. In connection with this arrangement two river wells, each 12 ft. in diameter and 34 ft. deep, have been sunk on the wharf, and the circulating water pipes extend nearly 150 ft. into the river. These pipes are 3 ft. in diameter, and the system used is that patented by Mr. Bowden, of the London Electric Supply Corporation. By means of this system the direction of the water in the pipes can be reversed from time to time, so that any mud or rubbish is periodically cleared out.

SWITCHGEAR.

There can be no doubt that the most interesting feature of the Stepney station is the switchgear, especially that used in connection with the high-tension circuits. Use is made of the A. Reyrolle's type of ironclad switchgear. This equipment is exceedingly compact, as will be gathered from the fact that the space made available at Stepney by its installation rather than the "warehouse" equipment is sufficient in area to allow two or three motor-converters to be installed if desired. This type of board is the first of its kind to be installed in London, although it has long been used with great success in Northumberland, Durham and other provinces. A good idea of its construction, which is carried out under the Clothier-Reyrolle patents, can be obtained from Fig. 5, whence it will be seen that all the high-tension conductors are completely enclosed in cast-iron chambers, and embedded in insulating compound or oil. This particular board is fitted with two sets of busbars made on the Highfield patent system, to either of which any generator or feeder may be connected, and which will normally be kept separate. Arrangements have, however, been made by means of the switch in the center of the board to connect both sets of bars together.

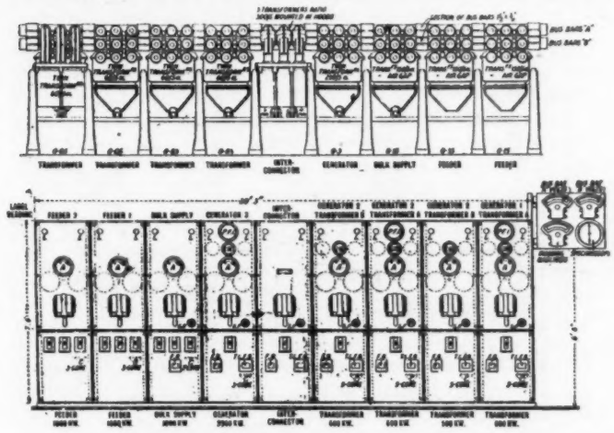


Fig. 5—Arrangement of Switching Devices.

The lead-covered cables from the generators enter into the specially designed cable-dividing boxes, into which they come through the floor immediately underneath, so that no obstruction due to cables is present behind the board. A wiped-lead joint is made between the cable and the dividing box. The principle of metallic covering for the generator cables is thus carried throughout the entire switchgear, including the series transformers, switches, busbars and feeders.

The switches used are of the carriage type, and while they are in position full protection is provided against any contact with live parts, while when the switches are withdrawn a neat set of folding doors automatically follow the switch out, and close over the orifices in which connection to the busbar has been made. This movable gear is interchangeable so that should one carriage break down a reserve one can easily and quickly be run in to take the load.

The front of the board calls for no special comment, being mounted with the usual instruments, relays and switch handles. These latter operate switches directly—that is, without the intervention of any electrical or mechanical apparatus, an arrangement which certainly is of the simplest and inflicts no hardships on the attendant, as the gear is directly under his hand, the muscular effort required being, therefore, of the slightest.

In connection with this switchgear, attention may be called to the system of generator and feeder protection provided. None of the usual trip coils is fitted, but instead the Merz-Price balanced system of protection is employed. This system is applied not only for the protection of the feeders, but also for the 2000-kw generators, and the smaller generators and step-up transformers. According to this system of protection, the current which is led into any healthy section must be similar in every respect to the current which is led out from that section, and by the insertion of series transformers at each end a balance is attained in the secondaries of the series transformers. The equilibrium is destroyed only when a fault occurs between the protection transformers. It is claimed that with this protection any faulty part on the system can be instantaneously isolated without interference with the continuity of supply through the other sound parts of the system.

The low-tension switchgear, which has been supplied by Messrs. Crompton & Company, calls for little comment. The positive, neutral and negative feeders are controlled from three separate boards, the first two of which are placed on the same gallery as the high-tension gear, while the last is erected on the floor of the engine-room. There are provided four sets of busbars to any of which the feeders may be connected by means of plugs, while the usual controlling gear and instruments are also supplied.

All of the electrical and mechanical equipment described above was designed and installed under the supervision of Mr. W. C. P. Tapper. The installation of the machinery was begun last summer, and the plant is now in service to supply the demands of the evening peaks.

AN ALASKAN HYDROELECTRIC DEVELOPMENT.

Electrical Refrigeration Plant of the New England Fish Company, at Ketchikan, Alaska.

By M. Adler.

PROBABLY the most completely equipped, electrically operated fish-freezing and storage plant in existence is the installation of the New England Fish Company at Ketchikan, Alaska. The New England Fish Company is a Boston concern and maintains a Pacific Coast branch at Vancouver, B. C. The company handles halibut and salmon for Eastern markets, the fish being caught on the British Columbia and Alaskan coast and, after being frozen, shipped to the East.

Fig. 1—View of Power House.

As an American concern operating out of Vancouver it en-

countered some difficulties with the Canadian Government in regard to sending the fish through in bond over the Canadian Pacific Railroad, and decided about two years ago to erect a new plant on American soil, at the same time extending the

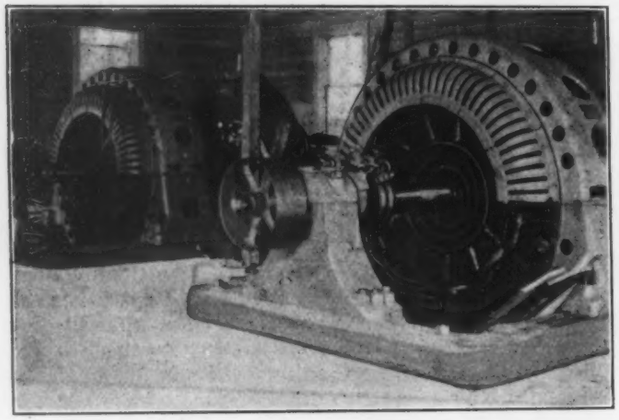


Fig. 2—View of Interior of Power House During Construction.

Canadian business. Ketchikan, in southeastern Alaska, was selected as the future location. Under the general management of Mr. A. L. Hager, of the Vancouver office, and Mr. John W. Stedman, as local agent in Ketchikan, the work was pushed to completion during the past summer.

The plant at Ketchikan consists of a cold-storage building, compressor room, wharf, warehouse and transformer house. In this section of Alaska abundant water-power is almost everywhere, and a favorable power house site was chosen about six miles from Ketchikan. The source of power is a lake, about one mile in length and one-half mile in width. The narrow valley is closed up by a 25-ft. log dam. The dam is of the so-called "K-truss" form, the end truss being taken up by the solid rock on both sides. The foot log is 3 ft. in diameter, bolted on the rock and the joints are concreted in. The total width of the structure at the bottom is about 30 ft.; on top, 65 ft. A flood gate, an intake gate with grizzly and a spillway have been built in. By means of a pipe line 2550 ft. long, a head of 340 ft. is obtained at the generating station, which is located at sea level. The pipe line consists of 1500 ft.

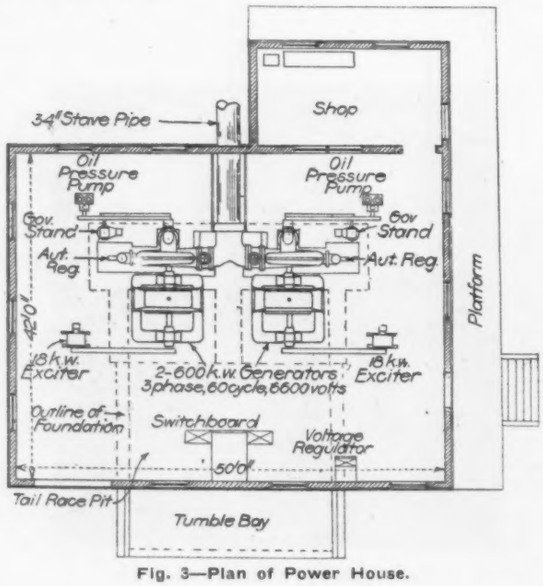


Fig. 3—Plan of Power House.

of 40-in. and 1050 ft. of 34-in. wooden-stave pipe; the first section is almost on the level and the second section has a grade of 1 to 3. The staves are made of Alaska spruce and were furnished by the local mill. The bands and cast-iron shoes were manufactured by the Ballard Drop Forge Company, of Ballard, Wash. At the lower end of the pipe the bands are spaced 1.5 in. apart, giving a factor of safety of 4.

The power house is 50 ft. wide and 42 ft. long; a shop adjoins the main structure. The building is of frame type, but

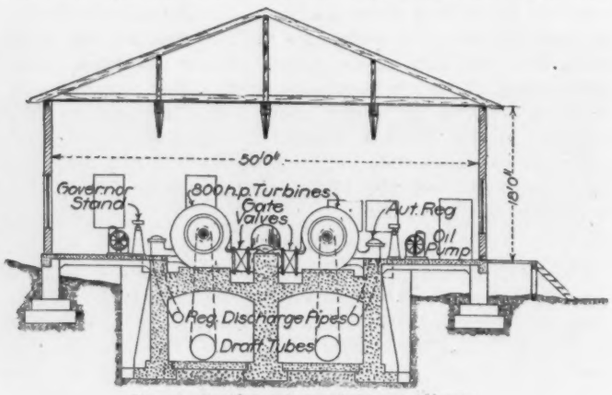


Fig. 4—Section Through Power House.

rests on reinforced concrete columns and on the concrete turbine foundation. This foundation consists mainly of two arches, 12 ft. wide and 9 ft. high, into which the two draft tubes and regulator discharge pipes empty. The draft tubes were molded in the concrete, as shown in the cross-sectional

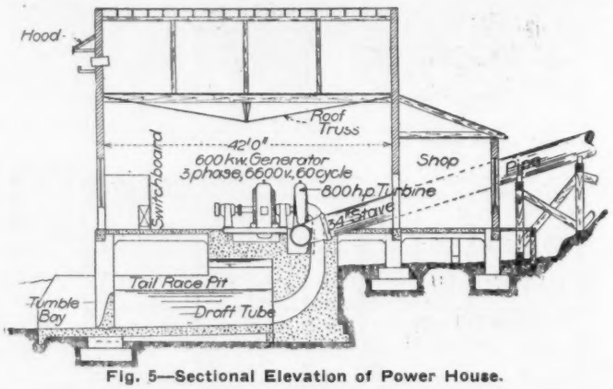


Fig. 5—Sectional Elevation of Power House.

view. The two arches extend to the front of the building, forming the tail-race pit.

The hydroelectric equipment, which was furnished by the Allis-Chalmers Company, consists of two 800-hp single hori-

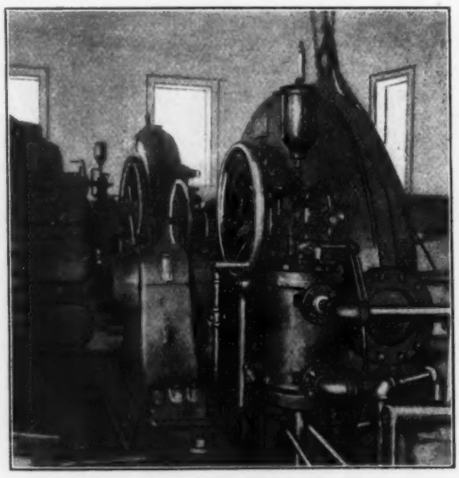


Fig. 6—View of Turbines.

zontal turbines in cast-iron spiral casing and with quarter-turn discharge, directly connected to 600-kw, three-phase, 60-cycle, 6600-volt generators, excited by 18-kw, 120-volt, belt-driven machines. The governor is of the oil pressure type, as de-

veloped by the Allis-Chalmers Company, consisting of a plunger pump with receiving tanks driven from the turbine shaft. A governor stand of flyballs of the Harting type and a servo-motor, actuating the turbine gates through suitable lever

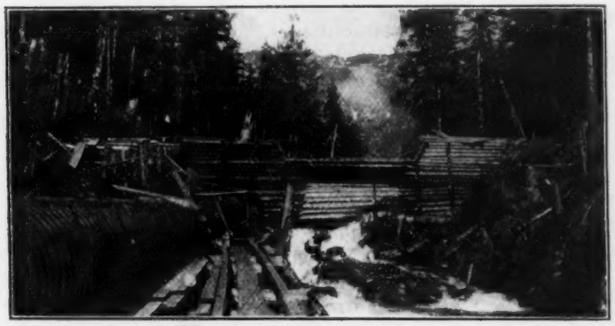


Fig. 7—View of Pipe Line, Dam and Watershed in Distance.

connections, is installed, as is also an automatic regulator taking care of all excessive pressures.

By means of a small hand pump, mounted on the servo-motor, the turbine gates can be operated by hand when the power pump is not available. The switchboard consists of two panels of standard type, Westinghouse instruments being used. A voltage regulator is provided for the outgoing line. Choke coils and lightning arresters are used as protective devices.

The output of the generating station is transmitted to Ketchikan over a line consisting of aluminum wire having the equivalent conductivity of No. 2 copper wire. The 100-ft. right-of-way follows closely the shore line, and has a length of about seven miles. A shorter route originally surveyed was abandoned on account of steep grades and the impossibility of handling material at advantage.

In the substation are installed three 250-kw, water-cooled transformers, reducing the transmission e.m.f. of 6600 volts to 440 volts for the motor units. Two 15-kw, 110-volt transformers serve the lighting purposes. In the compressor room two 65-ton vertical compressors made by the York Manufacturing Company, of York, Pa., were erected by the United Iron Works, of Oakland, Cal. They are belted to two 150-hp, three-phase, 440-volt induction motors, controlled by potential transformers and starters, the switchboard being equipped with Wagner instruments. As auxiliary machines are installed induction motors to drive an ice crusher, a hoist, a salt-water centrifugal pump, and the brine agitator. To facilitate the handling of the blocks of ice, weighting 400 lb. each, a Sprague electric traveling crane has been installed in the ice-making

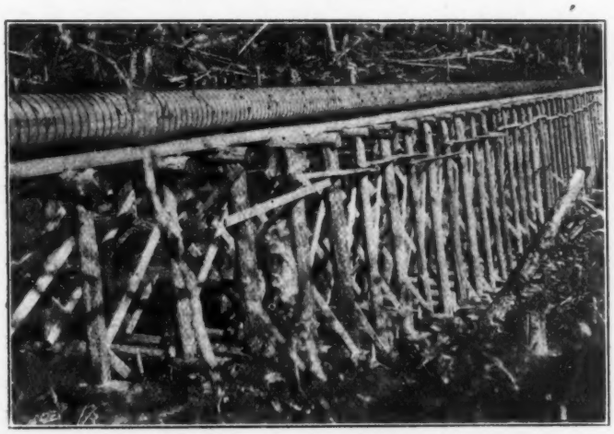


Fig. 8—40-in. Stave Pipe Over Trestle.

plant. An electric Otis elevator lifts the ice to the chute; another connects the first and second floors.

The storage building, which is considered one of the best on the Pacific Coast, is built along the most modern lines. Great care has been exercised in selecting the best possible material for the purpose of proper insulation, and every precaution is taken to insure that it has been put in place in the walls in the best manner. The building contains four rooms called "Sharp

Fig. 9—View from Summit, Showing Pipe Line Foundations and Power House in Distance.

freezers" in which 80,000 lb. of halibut can be frozen in 36 hours. It is well lighted and all the wires are put in conduit. About 250 lamps, carbon and tungsten, are distributed in the different buildings.

The plant was put in operation on Sept. 16, 1909, and the company already contemplates enlarging the storage capacity in the near future.

THE WIRELESS TELEPHONE.

A Discussion of Its Present Status and Probable Lines of Future Development.

By JOHN L. HOGAN, JR.

TELEPHONY without wires has been regarded as the intermediate step in electrical progress which leads from Hertzian telegraphy to the long-sought wireless transmission of power. All over Europe and the United States men have been working to perfect the wireless telephone, but they have been struggling in only three or four directions. During the past eight months the rapid improvement previously recorded came to a stop, and for some time no "records" of any sort have been made in radio-telephony. The inventors are at a standstill; they seem to have exhausted the possibilities of their few methods of operation, and to be unable to open new ground.

This lapse from activity is unfortunate, for it is preventing the wireless telephone from taking its place in a field which is peculiarly its own. When telephony by ether waves reaches a practical stage, it will find multitudes of uses under conditions that make wire telephones either impossible or inefficient. When reliable communication can be maintained over distances of 60 or 70 miles, the wireless apparatus will be installed on many merchant vessels and on all ships of the navy, and will be used between islands and from islands to the mainland wherever telephone cables are too expensive to lay and to maintain. As soon as the wireless telephone can cover distances of several hundred miles it will supersede long-distance wire telephony, provided that suitable telephone relays may be had. Off hand, it would seem that the substitution of wireless for wire "toll lines" would help the telephone companies only by the elimination of line maintenance expense; but consideration of the fact that ether transmission is distortionless shows the point in which the wireless method far leads any which depends upon conduction. Whatever distances Hertzian telephony may be made to cover, the voice waves will be transmitted with perfect

fidelity, and there will be none of the drummy, rasping noises which is so common in long-distance wire telephony. The rapid falling off in enunciation as the length of the wire line increases makes long-distance wire communication very unsatisfactory; and since the wave distortion is caused by a property of the wire itself, and not by the apparatus used, it cannot very well be overcome.

It is this distorting effect of the distributed capacity of wire that has caused many authorities to state that trans-Atlantic telephony by cable will never be realized. True, Pupin's inductive coils have been successfully used to neutralize the capacity of short telephone cables, but there is great doubt as to the possibility of their use in very long sub-oceanic cables. It would seem, therefore, that if telephony over exceedingly long distances will ever be effected, it must be done wirelessly.

Wireless telephones as they are at present do not suggest trans-Atlantic communication to even the most sanguine of those who have seen them. The earlier methods (operating on conduction and low-frequency magnetic induction principles) have done nothing that could not have been accomplished better by wire telephones. However, apparatus using Hertzian waves has been made to give very valuable results. Actual telephonic communication was established wirelessly between Brant Rock and Plymouth, Mass., a distance of 12 miles, several years ago. It is said that in this case the speech transmission was very nearly perfect, and that the enunciation of the wireless was distinctly better than that of a line telephone connecting the same points. The method used was due to Fessenden, and depended upon the variations produced by the voice in a continuous high-frequency current generated by an alternator especially designed for frequencies of the order of 40,000 per second.

Fessenden's alternator method is stated to have found application recently in voice transmission from Brant Rock to Jamaica, L. I. The Jamaica station was dismantled a number of months ago and detailed results of the tests are not available. If reliable communication was maintained over this distance of about 200 miles it should be an indication that the wireless telephone will soon have a commercial value.

Nearly all investigators other than Fessenden have used some form of the "singing" arc as their oscillation generator. The limiting distance for regular communication by arc methods (when using such antennas as are standard for the wireless telegraph) is doubtful, but seems very small. At present, Newark, N. J., is reached by wireless from New York at any time. Still, this communication can scarcely be considered as commercial, for the apparatus is uncertain and requires expert care to remain operative for even a short time. So long as portions of words drop out of a sentence because of irregularities at a transmitter, business will not be transacted by wireless.

It is true that arc methods have been used in talking over far greater distances than the 10 miles from New York to Newark. An outfit manufactured by the Telefunken Company, of Germany, was operated between the naval wireless telegraph stations at Brooklyn and Fire Island. The distance of approximately 50 miles was covered, but the articulation was not good because the transmitting apparatus was overloaded in order to radiate at a high enough power. So far as can be learned, however, the Telefunken apparatus has been tested no further.

The Eiffel Tower has been prominent in achievements of telephony by ether waves, for DeForest has been reported as making some surprising records (distances of 500 miles) made from there, and Jeance and Colin, of the French navy, have been credited with some very good work when using the tower antenna with their transmitters. They report, also, having covered wirelessly the 155 miles separating Toulon and Port Vendres. Poulsen, who is the pioneer in arc methods of wireless telephony, reported transmission over 300 miles, and promised trans-Atlantic telephony more than a year ago. If any of these feats of radio-telephony could be repeated time after time, whenever desired, they would be distinctly valuable. As it is, however, they mark, if anything, little more than the coincidence of a number of favorable conditions.

There are three methods of electrical wireless telephony, namely, conduction, low-frequency induction and high-frequency radiation. As details of all of these may be found in various published articles, it is unnecessary to consider here any more than the general mode of operation of each. Conduction methods depend on the small currents which will follow "the longest way 'round" in an earthed path, and are inoperative except for the smallest distances. Low-frequency induction apparatus gives good results up to 60 ft. or so, but is of no great value even for such small distances because of its waste of energy. For wireless communication over distances in which electrical transmission is at all desirable, the high-frequency methods must be used. The principle which underlies all these electromagnetic wave methods is the same: An oscillator produces a nearly continuous alternating current of very high frequency, a transmitter modifies this high-frequency current in accordance with speech vibrations, the energy of the modified current is impressed upon an aerial radiating system, and from there travels through etheric space in the form of Hertzian waves. A portion of the radiated wave produces a feeble current in an absorbing aerial at a receiving station, and its variations are then retranslated into sound by suitable receiving apparatus. The existing wave telephones are said to belong to the arc class or to the alternator class, according to whether they use arcs or alternators for the production of high-frequency currents. In general, both alternator and arc apparatus use some form of microphone for the wave-modifying element, though Fessenden has used a special type of condenser transmitter.

Having considered the field which is open for wireless telephony, together with what has been done to occupy that field, and, briefly, with what apparatus it was accomplished, there arises the question of why radio-telephony is doing no more. The answer to this is to be found, not in a decreased activity of the inventors, but rather in the fact that they continue their attempts to overcome difficulties which are inherent to the types of apparatus in use. The reason wireless telephony does not progress is that existing apparatus and methods have limiting features, and that the limits have been reached.

Current losses in shunt paths through the ground bar the conductive method from use. In the inductive method the distance covered is a function of the current in the transmitter's large inducing coil; this current must be modified by passage through a microphone; present-day microphones have a rather low-current carrying capacity, and so the maximum effective distance of a low-frequency induction wireless telephone is small.

The wave method is without doubt the best so far proposed, but both the arc and the alternator types have their limits. The distance over which speech may be had of course depends on the energy radiated effectively, and no more energy may be radiated than may be reliably and effectively controlled by the voice. Since the voice can control no greater current than a microphone system will handle, the limit of existing microphones affects Hertzian telephony. In addition to this restriction of output, experience has shown that the arc is not operative at high rates of emission, and that the limit of its power (i. e., the maximum activity in its oscillation circuits) has been found. The infrequent use of alternator oscillators does not supply any data as to their operating difficulties, but the great cost of their design and construction makes them impossible for general use at present.

It is, then, quite evident that future systems of wireless telephony must either eliminate the use of microphone transmitters or find types far in advance of those used to-day. In addition to this, some more powerful and more reliable oscillator must be substituted for the arc. If no great difficulties arise in its operation, and its cost be sufficiently reduced, this substitute may be the high-frequency alternator. With the few weak points of the present systems removed and the useful parts of the apparatus retained, the wireless telephone will come into all the uses to which it is adapted; but the elimination of the defects will involve a departure from present methods. Until these are discarded, attempts at commercial wireless telephony will be futile.

MOTOR LOADS AND INCOMES.

An Analysis of the Motor Business of Sixteen Central Stations.

By ALTON D. ADAMS.

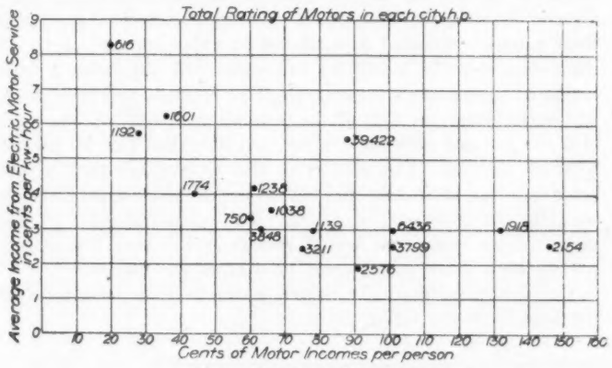
STATIONARY motors operated by electrical supply systems vary much in aggregate horse-power per unit of population in various cities, and in energy consumed per horse-power. Incomes from these motors also differ widely, both per unit of population and per kw-hour sold.

To trace the law of these variations in service and average rates, the following analysis has been made of the motor loads and incomes in the electrical supply systems of 16 cities. In the selection of these cities of a single State the aim was to secure those with important motor loads.

As tabulated, the details of motor loads, consumption and incomes are arranged in the order of the average cents received for this service per kw-hour. This average is, of course, obtained in each instance by the division of the total number of kw-hours sold during the year into the total number of dollars received for stationary motor service, without regard to the method of charging in vogue. In the diagram, the dots are arranged to correspond with the average number of cents received per kw-hour, as measured on the vertical lines, and with the cents of total income from stationary motor service per person in the population, as measured on the horizontal lines, for each city. At the top of the diagram the figures indicate the total horse-power of motors connected to the electrical supply system in each city at the end of the year in question.

ELECTRIC MOTOR BUSINESS IN 16 PLANTS IN 1908.

Average rate cents per kw-hour	Hp of motors connected.	Income per inhabitant Dollars.	Hp per 1,000 population.	Income per hp Dollars.	Kw-hours per hp.
1.88	2,576	0.91	51.6	19.30	946
2.46	3,211	0.75	35.9	21.18	869
2.50	3,799	1.01	44.0	23.06	922
2.54	2,154	1.46	65.0	22.36	879
2.97	6,435	1.01	58.0	17.40	584
2.99	1,139	0.78	48.0	15.80	527
3.00	1,918	1.32	50.0	26.04	865
3.03	3,848	0.63	39.0	16.14	531
3.34	754	0.60	20.0	30.15	900
3.56	1,038	0.66	33.0	19.70	552
4.03	1,771	0.44	19.0	22.78	564
4.17	1,238	0.61	44.0	14.04	336
5.58	39,422	0.88	56.0	15.73	281
5.74	1,192	0.28	11.2	25.55	445
6.24	1,601	0.36	12.2	30.17	483
8.29	616	0.20	7.7	26.88	319



Motor Loads and Incomes.

It may be seen by a glance at the table and diagram that the average rates range from 1.88 cents to 8.29 cents per kw-hour, but for nine of the 16 cities the range is from 2.5 cents to 3.5 cents per unit. Incomes from motors per person in the population reach a maximum of $1.46 and a minimum of 20 cents. That is to say, while the maximum is 4.4 times the minimum rate per kw-hour, the greatest is 7.3 times the least income per unit of the population, so that the incomes decrease much faster than the rates increase. Nine cities show average rates between 1.88 cents and 4.17 cents, and incomes between 60 cents and $1.01 per inhabitant.

Aggregate horse-power of motors per city ranges from 616 to 39,422. In only two of the cities considered is the horse-power of motors connected to the electrical supply system less than 1000, and in seven cities it is more than 2000, while the average rate per kw-hour in six of these seven cities is 3 cents or under. The next to the largest motor load is 6435 hp. With the exception of the largest city, the great bulk of the motor load is carried at average rates of from 2.5 cents to 4 cents per kw-hour.

In horse-power of connected motors per 1000 population the lowest figure is 7.7 and the highest is 65, a ratio of 8.4 to 1. The record of 7.7 hp per 1000 people is found in the city with the highest rates for motor service, the smallest motor load and the lowest earnings per 1000. Generally, it appears that the large motor loads per unit of population go with the low rates per kw-hour. Seven of the 16 cities have motor loads of 44 or more horse-power per 1000 inhabitants, and in only two of these seven cities is the average rate per kw-hour above 3 cents.

The energy consumed per motor horse-power is a maximum at 946 kw-hours and a minimum at 281 kw-hours. In general, the large use of energy per motor horse-power goes with the low rates per kw-hour. In 11 of the 16 cities the motors consume more than 500 kw-hours per horse-power. Dollars of annual income per motor horse-power are as little as $14.04 in one city and as great as $30.17 in another. Nine of the 16 cities show incomes for the motors of more than $20 per rated horse-power. Variations of the income per motor horse-power do not follow the rates per kw-hour, but the majority of the low incomes per horse-power are found in cities with low energy rates.

To sum up the above general view of service and incomes, it may fairly be said that low average rates per kw-hour, large aggregate horse-power of motors per 1000 of the population, large consumption of energy per motor horse-power, and large incomes per inhabitant are found in the same cities. Where the average rates for energy are high, the connected horse-power of motors per unit of the population, the use of energy per motor horse-power, and the total income from a given population are low.

Not all of the differences between the cities exhibited in the table and diagram can be explained by the rates, and a review of the local conditions is important.

The city that pays the highest average rate per kw-hour has the least total horse-power of connected motor load, the least horse-power per 1000 population, next to the least consumption of energy per motor horse-power, one of the highest incomes per motor horse-power, and the least income per inhabitant. In this city the average rate per kw-hour was 8.29 cents, the total horse-power of the connected motor load was 616, and this amounted to only 7.7 hp per 1000 of the population, the energy consumed per motor horse-power was 319 kw-hours, yielding $26.88, and the income from motors per person was only 20 cents.

This same city contained no less than 176 manufacturing plants, in 1905, and 109 steam engines of 51,190 total hp, or 469 hp on an average, were used to operate them. Much the most important line of manufacture was cotton goods, and the value of these goods alone was more than $22,000,000 for the year. As cotton mills use large amounts of power, the average of 469 hp for each engine was mainly due to this industry. Neither the mills nor the electric station use water-power in this city. It is an interesting question what the resulting motor load would be on this electric station if the average rate for motor service were reduced to 2 cents instead of 8.29 cents per kw-hour.

The lowest average rate here presented of 1.88 cent per kw-hour was paid in a city where the electric station had a connected load of 2576 hp in motors, or 51.6 hp of rating per 1000 people. These motors consumed 946 kw-hours per horse-power of rating during the year, on an average, or more than the motors of any other city in the group, and thus earned for the electric station $19.30 per motor horse-power and 91 cents per member of the population.

In this city there were no less than 179 manufacturing estab-

lishments with an output of goods valued at more than $30,000,000, during the census year of 1905. These factories employed 155 steam engines with an aggregate rating of 20,824 hp, or 124 hp on an average, and also 113 water-wheels rated at 24,130 total hp. Steam engines here represented 406 hp per 1000 people, compared with 641 hp in the above city with the highest rate for motor service. Water-wheels exceed the steam engines in rating in the city now under consideration, and if it were not for the use of engines to operate auxiliary to the wheels at times of low water, the engine power would no doubt be much less. Paper-making is the largest single industry here. The electric station operates partly with water-power, but the larger part of its output is from steam.

What can be done in a rather large city where the electric supply system operates with substantial amounts of both steam and water-power, and where but little water-power is used directly by the factories, is well illustrated by the central station that received an average of 2.5 cents per kw-hour for energy and had a load of 3799 hp in motors. These motors earned $23.06 per rated horse-power, or $1.01 per person, for the electric system during the year, and consumed 922 kw-hours per horse-power, the second largest figure for energy in the group.

No less than 296 manufacturing establishments devoted to more than a score of leading industries were reported for this last-mentioned city, but only 95 steam engines, with a total rating of 7643 hp, were in use. The average horse-power of these engines was thus 80, and the horse-power per 1000 of the population was only 88, or just twice the horse-power of connected motors.

In the city with next to the largest load of connected motors in the State—that is, 6435—the average rate for motor service amounted to 2.97 cents per kw-hour, and these motors represented 58 hp per 1000 people. From its motor load the central station got a revenue of $17.40 per motor horse-power and $1.01 per inhabitant on a consumption of 584 kw-hours per horse-power.

Manufacturing establishments to the number of 256 operated in this city, and the value of their product was more than $46,000,000 during the year, $19,000,000 of this amount being in cotton goods. Steam engines in the city numbered 298, with a total rating of 35,664 hp, or 119 hp each, on an average, and these engines represented 322 hp per 1000 people. Besides these engines the factories used water-wheels of 21,515 hp total rating, and a large percentage of the engine power was probably employed as a mere auxiliary to the water. The electric station operated entirely with steam power.

In the city with the greatest horse-power of steam engines in the State, the average rate for electric motor service was 5.74 cents per kw-hour, and the income per horse-power of connected motors was $25.55 during the year, amounting to only 28 cents per inhabitant. This city had motors of 1192 total horse-power connected to the electric supply lines, amounting to 11.2 hp per 1000 of its people, and these motors consumed an average of 445 kw-hours per horse-power. Factories in this same city numbered 234, and had in use 258 steam engines of 101,315 total horse-power, which amounted to an average of 392 hp per engine and to 958 hp per 1000 of people. Besides these steam engines the gas and gasoline engines in the city represented 264 hp, or 22 per cent of the electric motor rating. Most of the steam engine equipment appears to have been for regular use, for the factories had only 1003 hp in water-wheels. This showing of nearly 90 hp of steam engines to 1 hp of motors on the electric supply system, while the average rate for electric energy is 5.74 cents per kw-hour, carries a strong suggestion of what might happen under different electric rates. In the city under consideration the value of factory products was more than $43,000,000 for the year, and $32,000,000 of this represented cotton goods.

The electric supply system that obtained the highest income and had the largest load of motors, per inhabitant, charged 2.54 cents per kw-hour on an average, and earned $22.36 per motor horse-power and $1.46 per unit of the population. In the rather small city where the electric system just mentioned operated, the total rating of the connected motors was 2154 hp, or 65 hp per 1000 inhabitants, and 879 kw-hours were consumed per horse-power during the year. This city had 107 manufacturing industries that produced goods to the value of more than $15,000,000 during the year. For these industries 114 steam engines with 14,528 total and 127 average horse-power were employed; also water-wheels rated at 4818 hp. Steam was the only motive power for the electric system, and the market was exceptionally good for energy, as shown by the income. Engine rating was 440 hp per 1000 people in this city.

In the one great city of the group the motor load of the electric system was 39,422 hp, or 56 hp per 1000 people. A number of smaller places served by the system are included in these figures. While the average rate of 5.58 cents per kw-hour for energy used by these motors is high, the earning of $15.73 per horse-power is low, and the 281 kw-hours consumed per horse-power is the least in the group. Considering the great city without the other places receiving energy from the electric system, the number of factory plants was 2747, and their product exceeded $184,000,000 in value for the year. In these factories the steam engines numbered 585, with a total rating of 34,599 hp, or an average of 59 hp each, and their average horse-power per 1000 of the population was 58. There were also 102 gas and gasoline engines that averaged 14.7 hp each, a total of 1507 hp. The wonder is that an average rate of 5.58 cents per kw-hour has secured a motor load approximately equal to the steam-engine rating. The second wonder is how much engine equipment would remain if the rate for electric energy went down to 2.5 cents or 3 cents per kw-hour.

The future work of the electric motor is to replace most of the engines in the above cities.

Central Station

Management, Policies and Commercial Methods

REDUCTION OF BOSTON EDISON COMPANY'S RATES.

The Edison Electric Illuminating Company of Boston reduced its primary lighting rate from 12 cents to 11 cents per kw-hour, beginning with Jan. 1, and following the recent acquisition by the company of the suburban electric properties in Newton, Brookline, Waltham, Watertown and Chelsea. At the time when this consolidation was approved by the Massachusetts Gas and Electric Light Commission the company announced its intention of making an 8 1/3 per cent reduction in its maximum rate early in the year 1910, thus sharing with its customers the benefits of the merger. The reduction applies throughout the company's entire territory of 509 sq. miles, taking effect in 33 cities and towns, and affecting a population of 1,500,000 persons. Three years ago the rate was 18 cents per kw-hour; two years ago it was reduced to 15 cents, and last year to 12 cents. The 12-cent rate went into effect in all the newly acquired suburban properties on Oct. 1, when these were formally taken over by the company. The above reductions, combined with the introduction of tungsten lamps on a large scale, virtually make electric lighting 70 per cent cheaper to the consumer in the Boston district to-day than three years ago.

WINDOW AND SIGN LIGHTING AT HAVERHILL, MASS.

The Haverhill Electric Company has recently put into effect two new rates to cover tungsten window and sign lighting, based upon a flat charge per month instead of the usual meter charge. The company desired to insure to the consumer a definite charge for a definite number of hours of burning and to make a rate that will induce each customer to use his lamps for a stated period each night, thereby insuring for the company several hours' energy consumption after the peak load has been carried. The rates are offered subject to the following conditions:

a. Lamps are to be used for five nights per week until 10 p. m., and one night per week—Saturday—until 12 p. m.

b. The lamps are to be turned on by the individual storekeepers at such time in the day as may seem best. They are to be extinguished either by the company's patrolman or by a time switch.

c. Each customer does whatever wiring may be necessary to disconnect the window service entirely from the motor service, and to so arrange that the lamps may be controlled either by a time switch or by the patrolman at some point where the company may designate.

d. Time switches are sold to the customers at cost or rented at a charge of $1.25 per month. The charge includes maintenance.

e. The wiring in the window must conform to the requirements of the company for tungsten lamps, and the company assumes the right to inspect the installation at all reasonable hours.

The price for this service, including free renewals of the lamps, is:

20 cp	$0.50	per	month	per	lamp
32 "	0.65	"	"	"	"
40 "	0.95	"	"	"	"
80 "	1.50	"	"	"	"
200 "	3.65	"	"	"	"

Sign service is furnished under these conditions, except as to price, which is 8⅓ cents per lamp per month, including free renewals.

LOAD FACTORS OF FLASHER SIGNS.

The number of large flasher signs in our larger cities is rapidly on the increase. The sign designer and the advertising specialist are each striving to outdo the other in the originality and striking character of the signs put up to attract the attention of the public. Use is made of all sorts of "moving" or "live" signs in which some action is represented. Perhaps the chariot race idea is one of the most striking. An airship appears to fly nightly above one of the large department stores of Chicago, and the electric sign district of Broadway, New York, has various kaleidoscopic effects in mid air.

Most of these "moving" signs require a large number of lamps. The apparent connected load is, therefore, large. The central-station man who figures on the revenue from such a sign, however, is doomed to disappointment if he bases his calculations on ordinary signs used for six hours per night. The ordinary sign in use for six hours a day or one-fourth of the time, of course, has a load factor of 25 per cent. If, however, the sign is flashed and is very large with many motions, its load factor may fall as low as 5 per cent.

Two conclusions are to be drawn from the above facts, one for the central-station manager who is making rates for this kind of load and the other for the designer of such signs. If the central-station man is wise he will base his rate for such signs on actual maximum demand as measured by a maximum-demand or a curve-drawing meter. He will use a system of charging with a readiness-to-serve charge based on maximum demand plus a kw-hour charge; or a high rate for a certain number of hours' use per month of the actual maximum demand and a low rate for the balance. In other words, he should not assume any load factors in advance as a basis for rates. The sign designer, for his part, should aim to keep the load factor of the sign as high as possible in order that it may earn a low rate from the central stations which make rates for signs on a readiness-to-serve or maximum-demand basis. Of course, it would be absurd from the sign designer and advertising point of view to sacrifice advertising efficiency for load factor and lower operating cost. But there are many times where the difference between low-load factor and high involves no practical difference in advertising effect. For example, it is not always necessary to flash all, or a large proportion, of the lamps on a "moving" sign at once. The effect is frequently better if they are not all on at one time. This difference may have a marked influence on the operating cost. Some of the most effective signs of this class at present flash only a small proportion at once. First comes the action or moving part of the sign and then the advertising lines that go with it. To flash both at the same time would be to distract attention too much by the number of effects going on at once.

EDUCATIONAL WORK OF THE BALTIMORE N. E. L. A. SECTION.

The Baltimore Section of the National Electric Light Association, under the direction of the Consolidated Gas, Electric Light & Power Company, is now in the middle of its experimental lecture course given by Prof. Sidney W. Ashe. The company not having a suitable place to accommodate the large number attending the lectures, has secured an entire floor in the Maryland Telephone Building. This makes a very convenient arrangement, as it provides one large lecture-room accommodating 200 men; one room, which is being used as a reading-room and library, and an apparatus-room and work-

Some of the Members of Baltimore N. E. L. A. Section.

room. The room has been artistically illuminated and provided with blackboard and lecture table, which is wired for direct current and alternating current. Arrangements were made at the beginning of the course to allow others than members of the local N. E. L. A. section to attend. Members are charged $2 for the entire course of 20 lectures if employees of the company, and members of the N. E. L. A. $5 if they are employees and non-members, and $10 if they are non-members and non-employees. The $10 men are employees of the local telephone and railway companies and of the city department.

This course is the first of its kind which has ever been carried on in Baltimore, and naturally considerable interest has been aroused. At the lectures supplementary talks and discussions are carried on similar to the method first introduced in Brooklyn with such success. Among those who have so far spoken at the lectures may be mentioned Messrs. Herbert A. Wagner, Douglas Burnett, R. F. Bousall, A. S. Loizeux, W. P. Beyerle and J. S. Cruickshanks. Several of these appear in the accompanying photograph. In addition to this lecture course

a movement is under way to co-ordinate all of the lectures given in Baltimore under one central publicity and welfare committee. The Mayor of Baltimore and Mr. Douglas Burnett are members of this committee. The lecture course has so far been very successful.

CENTRAL-STATION FACTS AND FACTORS.

Investment, Income, Operating and Other Data of Seven Central Stations.

The table given in connection with this article is a continuation of the information previously published in this journal on central-station facts and factors. The first installment of this information was published in the *Electrical World* of April 29, 1909. A second installment appeared on June 24, 1909. A compilation of similar factors by Mr. Austin Burt, acting as a committee of the Iowa Electrical Association, appeared in the *Electrical World* of May 6, 1909.

The items in the table were selected after considerable thought and conferences with various central-station men. A study of them cannot fail to be instructive.

In the accompanying table, the company in column 16 has a large investment in a hot-water heating system covering a large area for a small town. This condition accounts for the high liabilities per kilowatt of station equipment. Its gross earnings per dollar of liability are not very good for a small station where higher percentages are to be looked for than in large cities. The gross annual electric earnings per kilowatt of rating, namely, $100, are excellent, and if the investment or liabilities were lower, this plant might make a remarkably good showing.

No. 17 is a station which has a very profitable combination of enterprises, namely, electric lighting and motor service, ice manufacture and exhaust-steam heating. A similar combination is found in No. 22. Both Nos. 17 and 22 have low liabilities per kilowatt of rating because they have for a number of years paid for part of the enlargements and new construction out of net earnings. No. 17 has only $240 liabilities per kilowatt, which is lower than many stations which have electric equipment only. The gross earnings of $194 per kilowatt for electric service, steam heating and ice, with the low liabilities, give a gross annual return on the investment of $80 per $100 of liabilities, which is a striking demonstration of the profitable results of working these three classes of service with one plant and one organization. No. 17 also has very high gross earnings per kilowatt of rating from its electric service alone, namely, $112. The electric earnings alone come to $7 per capita, which shows that the territory has been very thoroughly worked.

No. 18 is a municipal plant in which the bonds outstanding against the plant probably represent less than the real investment. This fact accounts for the low figure of $93 liabilities per kilowatt of station rating and also indicates that the station equipment may be in excess of the distribution equipment. The gross earnings are $38 per $100 of liabilities, which is somewhere near an average figure for small plants. This plant is devoted mainly to serving the business district and all the per capita figures are low.

No. 19 is a somewhat typical case of a plant rated at 5000 kw. With liabilities of $314 per kilowatt, the gross earnings are $91, and the gross yearly income is $29 per $100 of liabilities.

No. 20 is a station which also has unusually good earnings per kilowatt of capacity, namely, $106.

No. 21 is in a large city and supplies energy to the city and a number of suburbs, so that the population served is rather indefinite and no figures on population served are given. It has always been noted for excellence of management and sound financial condition. The gross income per $100 of liabilities is $30, which is rather higher than prevails in companies operating in very large cities. If the gross earnings of successful companies operating in large cities are compared with the successful companies in small cities, the gross earnings per $100 of liabilities are much larger in the small cities.

No. 22 is one of the combination electric, ice and steam-heating stations before spoken of. It also supplies electric service in a number of surrounding towns. Its earnings are not so high in proportion to the investment as those of No. 17, which is a similar combination. This result is mainly due to the fact that a considerable part of the distributing system of the company is in towns where the density of business is very low because they have only recently been given electric service. With a small addition to the company's liabilities, the revenue can be increased considerably.

TABLE III.

	Number of Company						
	16.	17.	18.	19.	20.	21.	22.
A.—General Information.							
Rated kilowatt of stations	130	250	280	5,000	800	60,000	290
Total population of district served	5,000	4,020	3,000	100,000	25,000	..	7,700
B.—Utilization of Investment and Apparatus.							
Total liabilities per kilowatt of station rating	*$550	‡$240	$93	$314	..	$227	‡$300
Gross yearly income per kilowatt of station rating	†$100 & *$178	‡$194 & †$112	$35	$91	$106	$69	‡$147 & †$82
Gross yearly income per $100 of liabilities	*$32	‡$80 & †$46	$38	$29	..	$30	‡$48
Per cent of gross yearly income spent for operation (including everything but interest and depreciation)	*76	60	54	..	50	67	55
Yearly operating expenses per $100 of liabilities	$25	‡$48	$40	..	..	20	$27
Average income per consumer	†$37	†$62	$45	..	..	..	†$29
Total connected load in kilowatt per kilowatt of station rating	..	2.7	1.25	..	..	..	1.9
Connected kilowatt load in lamps per kilowatt of station rating	..	1.4	..	..	..	0.94	1.2
Connected kilowatt load in motors per kilowatt of station rating	2.2	1.16	..	..	0.86	..	0.5
Connected kilowatt load in heating apparatus per kilowatt of station rating	..	0.14	..	..	0.19	..	0.2
Kilowatt-hours sold or accounted for per 100 kw-hours generated	..	..	..	..	..	68	72
Kilowatt transformer rating per kilowatt of alternating-current station rating	..	..	..	..	..	..	0.7
Kilowatt transformer rating per kilowatt of connected load	..	..	..	..	..	..	0.38
Kilowatt transformer rating per kilowatt connected in residence districts	..	..	..	..	..	..	..
Kilowatt station rating per employee, all departments	22	..	..	..	..	..	‡20
Yearly load factor (average load divided by maximum)	..	..	0.20	..	..	..	..
C.—Development of Territory Served.							
Gross yearly income per capita of population	*$4.60	†$7 and ‡$12	$1.10	$3.10	..	..	$5.55
Liabilities per capita	$14.40	‡$15	$3	$10.74	..	..	$11.20
Watts station rating per capita	26	63	20	50	..	..	38
Number of consumers per 100 of population	†6.9	..	3	..	..	..	7.2
Number of residence consumers per 100 of population	..	..	0.5	..	..	..	..

* Includes a hot-water heating system.
† Electric only.
‡ Includes ice and steam-heating system.

CENTRAL-STATION EXPERIENCE WITH ELECTRIC VEHICLES.

Comparative Records of the Operation of Electric and Horse Vehicles Show the Former to Be Cheaper.

Something like 10 years ago the Commonwealth Edison Company, of Chicago, purchased nine electric delivery wagons, and they were operated five or six years, but did not prove to be a real success, as the cost of repairs and operation was very high and it seemed impossible to keep the rigs in a presentable condition. However, during the year 1906 these rigs were rebuilt, practically making new machines out of them. Since that time numerous improvements have been added. A garage has been built, and all of the company's automobiles, as

well as its horses and wagons, have been put in charge of a competent superintendent, who devotes his entire time to the work. The result has been that these electric delivery wagons, including some eight additional rigs, which have been purchased since, are now making a remarkable showing from the viewpoint of cost of operation, as well as in service and appearance.

The company has now become an enthusiastic believer in electric automobiles and has several more electric machines, of different types, on order. Horses and wagons are being supplanted as rapidly as practicable with electric wagons. As radical a change of policy as this was not determined without careful study of the cost of operation, this study having been made possible by the keeping of complete statistics for several years on the cost of operating the company's automobiles as well as its horses and horse vehicles.

Cost of horses and horse vehicles has not changed materially, although there has been a tendency to increase, but the cost of the operation of the company's electric wagons has gone down in the last three years at a rapid rate. In fact, the cost has now reached the point, in the opinion of the officers of the company, where, aside from the question of more prompt and efficient service, of the advertising by the use of electricity, of cleanliness and other considerations, all in favor of the electric vehicle, it is less than that of the horse rig, when proper consideration is taken of all factors of cost. To establish this point clearly statistics have been prepared with great care and thoroughness by the statistical department of the company.

The statistics given are for a period of the first 10 months of 1909, or from January to October, inclusive. The company had in operation at the end of this period 17 electric wagons. But in presenting the following statistics, showing the days in use and the average mileage, figures on 12 of the 17 have been included, as the other five rigs have been used in pulling cables during the 10-month period. The new rigs now on order are to be used principally for the delivering of incandescent lamps for renewals, which service is now taken care of with horse rigs.

Table I shows the actual number of days that each rig was idle, in the repair or paint shop, or in use on the streets, the idle days consisting almost entirely of Sundays and holidays. Occasionally a rig is used on a Sunday or holiday delivering supplies for important street work. These figures have been carefully kept by months and by classes of service, but for the present purpose the following summary will answer:

TABLE I.—SERVICE OF VEHICLES.

Total days in use during 10 months	2414
Total days in shops	165
Total days idle	487
	3066
Less Sundays and holidays	493
Total working days	2573
Per cent of days in shops to total working days	6.4

Data prepared by the statistical department show the actual number of miles made each month for each rig. There were great variations in miles for the month for the different rigs. For instance, some of the rigs regularly made over 1000 miles per month, but the average was about 654 miles per month.

In Table II is given some interesting information. The most important point is the gradual and very considerable improvement in the average mileage per working day per rig, the rigs in use delivering supplies showing an improvement from 21 miles per day for the first few months to 28 miles per day for the last few months of the period, or an improvement of 33⅓ per cent, and the total of all of the rigs, comparing beginning and end of the period, shows an improvement of 43 per cent.

Another important point is the high average maintained by the rigs used in delivering meters and the Electric Shop

TABLE II.—AVERAGE MILES PER WORKING DAY.

Delivering supplies to and from warehouse—

Auto No.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Average for 10 Months
1	23	20	23	30	28	31	25	32	27	27	27
2	18	16	21	24	22	24	22	24	20	24	22
3	13	10	13	14	10	23	23	18	25	18	17
4	23	23	24	32	32	31	29	29	26	23	27
5	19	19	20	27	21	25	..	—Transferred—		..	22
6	25	25	28	23	32	32	28	32	33	32	29
7	28	20	21	25	22	26	26	27	23	24	24
8	28	26	34	34	33	33	28	34	32	35	32
9	19	19	5	21	24	18	—Transferred—		30	24	20
10	..	..	..	..	..	..	..	31	34	35	33
Total	22	20	21	26	25	27	26	28	28	27	25

Delivering meters to customers' premises—

Auto No.	June	July	Aug.	Sept.	Oct.	Average
11	43	41	43	41	37	41
9	..	31	36	—Transferred—		34
12	..	..	..	36	41	39
Total	43	36	39	38	39	38

Electric Shop wagon—

Auto No.	July	Aug.	Sept.	Oct.	Average
13	40	36	39	33	37

Average of all above—

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Average for 10 Months
Mileage	22	20	21	26	25	29	30	31	31	30	27
Number of Rigs	9	9	10	10	10	10	10	11	12	12	..

and for street-department emergency wagon and other service where statistics on a mileage basis would be misleading and incorrect, the value of machines on this work not being in the distance covered, but in the saving of time.

Of the 12 rigs in service at the end of the period, nine were used in hauling merchandise from the freight yards to the storerooms and in delivering supplies to customers' premises or to the different jobs which the company had on hand during this period; two of the rigs were used exclusively in delivering meters necessary for the connecting up of new customers, and one of the rigs was used for delivering supplies from the company's newly established Electric Shop, a retail store in the shopping district exclusively for the sale of energy-consuming devices. Five of the 12 rigs were purchased rig, which show an average, for the five months they have been in operation, of nearly 40 miles per day, or over twice the mileage that could possibly be maintained by a single horse and wagon.

The additional wagons on order will be put into service, as above stated, in delivering lamp renewals, a service in which it is anticipated that the average mileage will fully equal the one just above quoted, so that a further considerable improvement in the total per working day per rig of 30 miles to 31 miles for the last five months up to 33 miles to 35 miles, or more, during the next year is anticipated.

Table III shows the total kw-hours of charging energy by months for all of the company's electric machines. Attention should be called to the gradual reduction of kw-hours per mile,

the first five months showing an average of 0.66 kw-hour per mile, the last five months averaging 0.56.

TABLE III.—CHARGING ENERGY.

Month—	Kw-hour Input	Total Mileage	Kw-hour Per Mile
January	4793	5838	.82
February	3570	5053	.73
March	4140	7168	.57
April	4814	8020	.60
May	4545	8031	.57
June	4849	8207	.59
July	5370	8946	.60
August	4920	9862	.50
September	5628	9833	.57
October	5978	10905	.55
	48607	81863	.59

One meter measures the total energy used for charging all the vehicles, but arrangements are now being made to have a separate meter on each charging plug and records will be kept in the future of the charging energy for each machine. It is confidently believed that the machines shown in Table II as making the highest average miles per day use the least energy per mile, but at present there are no statistics to prove this point.

In presenting Table IV, showing the cost of maintenance of electric wagons, it should be stated that all of the rigs included in this table, as well as in the preceding tables, are of 1.5-ton rating; also that the cost of maintenance, as shown in Table IV, includes the five rigs which were mentioned previously, which are not included in the preceding tables for the reason that it would be difficult properly to separate the cost of operation of these five wagons from the other 12 and also because the cost of maintenance and up-keep of these five wagons is not materially different from the other 12.

The garage and shop expense has been divided between the electric wagons and the passenger cars in the proportion to the number of each, the amount shown below is the wagon portion only, not including, however, the portion chargeable to the five-ton electric truck, used principally in the hauling of reel of cable, tile, etc. The portion of supervision expense chargeable to electric wagons has been obtained by apportioning the entire supervision expense of the transportation department between electric wagon, passenger automobile and horse and horse-vehicle expense in the proportion that each bears to the total operating expense of the three classes of service.

The cost of energy used in charging has been figured at 4 cents per kw-hour, although this rate may be a little too high for customers using a considerable number of rigs and is somewhat low for customers having only one rig to charge.

The "cost per mile in cents" figures are simply average costs and it should be borne in mind that the cost per mile for rigs making a large mileage will be very much lower than the average.

This table, it is believed, is a complete statement, showing, as nearly as it is possible to obtain it, the true cost of operation of electric wagons.

TABLE IV.—MAINTENANCE OF ELECTRIC WAGONS.

Month—	Number of Vehicles	Accessories	Supplies	Painting	Purchase and Repairs— Tires	Battery	General	Garage and Shop Expense	Electric Energy at 4 cents per Kw-hour	Total Expense	Miles Traveled	Cost per Mile in Cents
January	13	$11.22	$40.10	.....	$28.54	$39.71	$184.05	$317.96	$191.72	$813.30	5,838	13.9
February	13	3.27	28.36	.....	2.50	144.66	64.17	309.00	142.80	694.76	5,053	13.7
March	14	102.57	30.76	$28.50	150.07	136.40	337.20	277.90	165.60	1,229.00	7,168	17.2
April	14	.....	32.25	28.50	50.04	336.60	176.78	309.40	192.56	1,126.13	8,020	14.1
May	14	.....	10.45	28.50	139.60	Cr 117.32	152.07	236.87	181.80	631.97	8,031	7.9
June	14	.....	7.75	.....	142.59	239.31	329.56	366.26	193.96	1,279.43	8,207	15.6
July	14	.....	46.16	28.50	213.23	Cr 9.81	39.40	384.34	214.80	916.62	8,946	10.3
August	15	.....	36.06	.....	252.19	176.93	80.27	339.91	196.80	1,082.16	9,862	11.0
September	15	.....	2.05	.....	4.50	84.58	175.02	535.24	225.12	1,026.51	9,833	10.4
October	17	.....	15.00	.....	206.90	212.88	366.60	355.64	239.12	1,396.14	10,905	12.8
Total	143	$117.06	$248.94	$114.00	$1,190.16	$1,243.94	$1,905.12	$3,432.52	$1,944.28	$10,196.02	81,863	12.5
Cost in cents per mile	.14	.31	.14		1.45	1.52	2.32	4.19	2.38	12.5		
Cost per wagon per month, after deducting 6 per cent for wagons in paint and repair shop	$0.87	$1.85	$0.85		$8.85	$9.25	$14.18	$25.55	$14.48	$75.88	572	...

TABLE V.—EXPENSE OF ELECTRIC WAGON PER MONTH.

	Without package boy at 27 miles per day	With package boy at 43 miles per day
Operation, repairs and charging energy (see Table No. IV)	$75.88	$75.88
Supervision of machines and garage	5.22	5.22
Driver	65.00	65.00
Package boy to assist driver	....	26.00
Rent of garage	5.18	5.18
Municipal wheel tax and State license	2.67	2.67
Interest at 5 per cent, taxes at 1½ per cent, and insurance at ½ per cent, or total of 7 per cent on purchase cost of rig, assumed at $2,300	13.42	13.42
Depreciation at 10 per cent on assumed cost of rig $2,300, less assumed cost of batteries and tires, $1,000 = $1,300	10.83	10.83
Total cost per month per rig	$178.20	$204.20
Average cost per mile on basis of 25½ days Per month	25.9c	18.6c.

TABLE VI.—STATEMENT OF HORSE-VEHICLE EXPENSE, 10 MONTHS, JANUARY TO OCTOBER, 1909.

Total number of horses	135
Less 6 per cent to allow for sickness, being shod, idle, etc	8
Number of horses in service each working day	127
Feed, shoeing and veterinary services	$20,468
All labor in barn, including cleaning of wagons, harness, horses and stables, repairs to barn buildings, disposal of manure, cleaning supplies and tools: assume one-half chargeable to horse expense	7,728
Total horse expense	$28,196
Cost per horse per month in service	$22.20
Total number of horse vehicles	111
Less 6 per cent to allow for days idle and in repair shop	7
Number of horse vehicles in service each working day	104
Repairs of horse vehicles and harness	$6,939
One-half cost of barn maintenance (as above)	7,728
Total horse-vehicle expense	$14,667
Cost per horse vehicle per month in service	$14.10

	One-horse rig making 15 miles per day	Two-horse rig making 15 miles per day	One wagon, one driver and two horses for one horse rig, 30 miles per day
Maintenance of horses (as above)	$22.20	$44.40	$44.40
Maintenance of horse vehicle (as above)	14.10	14.10	14.10
Supervision of horses, horse vehicle and barn	2.10	3.15	3.00
One driver	55.00	65.00	55.00
Package boy to assist driver	....	....	26.00
Rent of barn	4.05	6.60	5.85
Municipal wheel tax	.42	.84	.84
Interest at 5 per cent, depreciation at 10 per cent, taxes at 1½ per cent, and insurance at ½ per cent on horse valued at $225, wagon at $200, and harness at $75 = total of 17 per cent on $500	7.08	12.75	10.26
Total cost per month per rig	$104.95	$146.84	$159.45
Average cost per mile on basis of 25½ days per month	27.4c	38.4c	20.8c

Table VI is presented in order to show, for comparison, the actual cost of horse vehicles. This expense has been divided into two parts: first, the horse expense, and second, the vehicle expense, in order to show the relative cost of rigs with one

or two horses. This division as between the horse expense and vehicle expense, of course, can only be approximate, but the total is the true actual cost, and it is the experience of the company that this cost has been increasing for several years due to the advancing prices for feed and other supplies.

Referring to the three headings in the concluding portion of Table VI, the first column is for service requiring some considerable time for loading and unloading and carrying too much load to cover any great distance; the second column is for two-horse rigs with heavier wagons of somewhat greater haulage rating covering the same distance; the third column being for light rigs, used principally for delivering lamps for renewals, which compares with the usual department-store service

TABLE VII.—SUMMARIZED COMPARISON OF TOTAL COST OF OPERATION OF ELECTRIC AND HORSE VEHICLES.

(All rigs in service using average mileage.)

	Electric wagon at 27 miles	One-horse rig at 15 miles	Two-horse rig at 15 miles
Total cost per month, dollars	178.20	104.95	146.84
Average cost per mile, cents	25.9	27.4	38.4

(Assuming rigs in service in which maximum mileage is possible.)

	Electric wagon at 43 miles	One-horse rig at 20 miles	Two-horse rig at 20 miles
Total cost per month, dollars	178.20	104.95	146.84
Average cost per mile, cents	16.3	20.6	28.8

for making retail deliveries, where it is usually customary to make a morning and afternoon trip each day using two horses, one for each half day.

Regarding the question of mileage, in past years when horses were used on the street cars 13 miles was considered the most that could be gotten out of a horse every day, seven days in the week, and 15 miles, according to the best local authorities, is all that can be gotten out of a horse each day, six days in the week and 52 weeks in the year, and keep the horse in presentable condition. Odometer readings, which have been taken at random on several of the Commonwealth Edison horse rigs, indicate that 15 miles is about the correct average.

The item for supervision, apportioned between the three columns, is, of course, somewhat arbitrary, but an average of the three represents an exact apportionment of the supervision expense of the transportation department.

COMPARISON WITH DEPARTMENT-STORE DELIVERY HORSE RIG, INCLUDING ONE PACKAGE-BOY IN EACH CASE.

	Electric wagon at 43 miles	One wagon, one driver and two horses for one-horse rig at 30 miles
Total cost per month, dollars	204.20	159.45
Average cost per mile, cents	18.6	20.8

Table VII speaks for itself, and when it is considered that the cost of horse rigs is rather increasing than decreasing and that the cost of electric rigs is rapidly decreasing, due to improved equipment (which means better efficiency and increased mileage) and to lower cost of energy for charging, it seems that the electric automobile should come into more general use, not only from the viewpoint of better service, better appearance, cleaner pavements, etc., but also from the viewpoint of cost of operation.

Wiring and Illumination

EQUIPPING LINEMEN WITH TELEPHONES.

By arrangement with the telephone company, the linemen of the Rochester Railway & Light Company are enabled to get into quick communication with headquarters from any street having overhead telephone wires. This not only materially accelerates the work, but at the same time keeps the men out of saloons, usually the most accessible place to find a telephone, and is of very great advantage at night, when it is hard to get the use of a telephone anywhere. Reference to the accompanying illustration shows the type of hand micro-telephone used and the method of connecting it to the wires. If the illustration be examined closely it will be seen that the lower man has made an attachment to the wires on the lower cross-arm, which are the telephone wires, and is holding the receiver of the hand micro-telephone to his ear.

The linemen are quite careful in cutting in on a line, and if the lines tapped are found to be busy, they do not interfere with the communication, but try another line. By taking this precaution, the lighting company has never had any complaint from the telephone company owing to interference with the service. The scheme has been found very serviceable in night patrol service. In Rochester, the lighting company is penalized for all outages of arc lamps. If a lamp remains unlighted for five hours, the deduction is equivalent to an entire night's outage. If the lamp is out the second night a deduction equal to twice the rate charged is made and if the lamp is unlighted for three successive nights the deduction made is equal to five times the rate charged. Because of this, but chiefly to guarantee to city and customers alike the best service possible, the company organized a night patrol service. In order that the patrol linemen may keep in touch with the main office at all times so that any reports of outages or trouble may be remedied with all speed, they call up the office at frequent intervals. If no telephone is available the lineman climbs a pole and taps the telephone wires, and if he is already on a pole for any reason before coming down he telephones to the head office for any instructions. The plan has been fraught with excellent results.

Linemen with Telephones.

ILLUMINATION GLARE.

It is coming to be realized more and more in illuminating engineering circles that not only must the sources of light be considered, but also the surfaces illuminated. For example, when the page of a book is illuminated one is enabled to read

what is on it by the difference in the reflecting power of the white page and the ink with which the letters are printed or written. When too much light intensity is on the paper so that the surface of the paper reflects too much into the eye of the reader, the eye is partially blinded and cannot read. The intensity of illumination which is sufficient to cause difficulty in reading depends on the illumination of the surroundings. An intensity of illumination that would be blinding on a page in a dark room would be quite tolerable in the open on a bright day. It is a matter of contrast rather than absolute value. It has been shown that outdoors with a partially illuminated sky surrounding the observer there is required a much higher intensity of illumination in foot-candles to read instruments than is required by night. This is undoubtedly due to the effect of the surrounding sky illumination on the eye.

At the present time this matter of regular reflection from the objects illuminated which causes such a glisten as to interfere with the ease of seeing is justly receiving more attention. Much has been heard about the bad effects of lamps which are not properly shaded when they are placed above the users. However, as a matter of fact, much of the trouble may be from below, from the glare reflected from the paper, metal or what not that may be worked upon. The glare from the work from below is merely the reflection of the glare of the lamps from which the illumination is obtained. The glare from the page of glazed paper is the reflection from one particular lamp placed relatively near to the paper. The nearer the lamp is placed to the paper, the more pronounced is the trouble. It is for this reason that systems of general illumination, as against a lot of individual lamps for each person, are coming into use. The individual lamp over each desk or workman's bench is tolerably sure to make trouble by reflection from the work at certain angles, and it is not always easy for the worker to avoid those angles. To prevent trouble from the reflection from below, the light must fall on the work from a number of lamps or from large diffusing surfaces.

ELECTRICAL INSPECTION.

At the regular weekly luncheon of the Electric Club of Chicago, on Jan. 5, Mr. B. E. Blanchard, chief electrical inspector of the Chicago Board of Fire Underwriters, was the principal speaker, his subject being "Electrical Inspection." Mr. H. E. Niesz, vice-president of the club, presided in the absence of the president, Mr. F. P. Vose.

Mr. Blanchard alluded to the great improvement in the design and construction of electrical machinery and apparatus since the early days of the art. He told how the National Electrical Code came to be formed, mentioning the early work of Mr. C. J. H. Woodbury, of Boston, in connection with efforts to establish rules for electrical wiring. Other organizations took up the subject about the same time, and about 1895 a national conference was held in New York. This conference adopted rules for the construction of electrical work, and so well was its work done that the underwriters adopted these rules. Now a large number of electrical and insurance organizations are affiliated in this conference, and the Code has been subject to a number of revisions, the latest issue bearing the date of 1909.

The electrical inspector should be a man who is honest; he should have many qualifications, but whatever else he is, he should be a close student of the Code. It must not be forgotten that the efficiency and degree of fire hazard of an electrical mechanism cannot be determined by simply looking at it; the apparatus must be subjected to careful test. Furthermore, electrical apparatus should be carefully maintained as well as installed according to the most approved practice. Atlanta is the only city in the United States where the underwriters have a department for reinspecting electrical equipment. Probably, however, this example will be followed in other cities, for the practice is an excellent one. In the stockyards in Chicago, where it is particularly difficult to maintain electric wiring in good shape, maintenance crews are constantly at work, going from one building to another, keeping the equipment in good condition.

The speaker gave some idea of the many questions put to electrical inspectors by owners of the apparatus inspected. A frequent inquiry relates to the length of time that will elapse before the inspectors come around again, asking that other changes may be made. The most common criticism to which electrical inspectors are subjected has to do with the frequent changes in rules. Mr. Blanchard pointed out that it takes from three to five years to investigate defects in electrical construction, devise rules to meet them and officially promulgate these rules. In general, the interpretation of the Code is becoming more uniform. There are two associations of electrical inspectors, the National association and the Western association, and their efforts have much to do with uniform interpretation. After all, however, something must be left to the "horse sense" of the individual inspector. In the future, Mr. Blanchard believes that advances in electrical construction and inspection will be much more rapid than they have been in the past.

Mr. Niesz spoke of the mutual benefit of co-operation between underwriters and the electrical interests. He told of the high rate on power houses in the past when insurance men did not understand the great improvements that had been made in the art. Mr. Niesz mentioned an instance where a representative of the underwriters accompanied him on a visit to a modern electric power house and found out that there was really nothing to burn. The result was that the insurance rates of the company owning this power house were reduced by about one-half.

Mr. Blanchard remarked that there is a constant inquiry from small towns in relation to the establishment of electrical inspection departments. Mr. F. J. Postel said that re-inspection of electrical risks is at least as important as the original inspection. In answer to Mr. Postel's question, Mr. Blanchard said that the underwriters' inspectors in Chicago only make re-inspections at present on request. There is no fixed time for re-inspection. The best thing, of course, is to have a regular system of re-inspection. By so doing, electrical wiring will be kept in good condition at less cost than where a great deal of improvement has to be done at long intervals.

Mr. W. S. Taussig called attention to instances of amateur wiring in residences. Mr. Blanchard said that residences are regarded as preferred risks, and are subject to few electrical inspections after the equipment has been originally passed. He mentioned that among Chicago suburbs, Wilmette is providing for inspection and that Oak Park has had such a system for some time.

Mr. J. G. Learned spoke of the requirements in relation to fire pumps and the replacing of steam fire pumps by electrically driven pumps. Mr. Blanchard explained that the underwriters have specifications for electrical installations of this kind, although they are not given in the standard rules. However, these specifications do not differ greatly from the regular rules relating to motors. No fuses are needed and the circuit-breakers are set high. A 1000-gal. pump operating against 150 lb. pressure will require a 150-hp motor. The governor is arranged to start at 130 lb. pressure and stop at 150 lb., the operation of the pump thereafter being controlled by air pressure.

THE ELECTRICAL CONTRACTOR IN GREAT BRITAIN.

Antagonistic Relations Between Contractors and Central Stations, Which Works Injury to Both.

By Glenn Marston.

It is difficult to convince a Britisher that the contractor and central station can co-operate so that each will benefit. The present relations between the stations and the contractors are, in many cases, far from friendly, the central station holding that the contractor pays no attention to its needs, while the

contractor complains that it is outside the central station's province to do wiring or a supply business.

The British contractors have an association, which publishes *The Electrical Contractor* monthly, with a membership of about 300. While the association is ably officered, it has been charged that the esprit de corps is low, and that the organization has accomplished very little along the broad lines laid down by its president, Mr. William Finlay.

The complaint of the central stations regarding the attitude of contractors is justified. The fault, however, lies partly, at least, with the central stations themselves. The contractors are naturally out for the class of work which yields them the greatest profit. This is fixture business, and so they go merrily on canvassing for house-wiring jobs and boosting the central-station's peak. The central station usually does one of two things; it either sits back and howls impotently at the contractor, or it goes into the wiring and supply business itself. It may be here remarked that the average load factor in Great Britain is less than 18 per cent as against an American average load factor of 25.3 per cent. In no case which came under my observation did the central station attempt to direct or assist the contractor toward securing business which would favorably affect the load factor.

The attitude of the central station is that which formerly prevailed in the United States—"Here is the current; if you want it you must come to us or do without." Most managers do not seem to understand that neither the central station nor the contractor can continue in business without the other. The manager feels that he need not canvass for current, because the contractor canvasses for fixture business, and fixture business must mean more current.

There is no doubt that the British load factor could be raised to 25 per cent—or even higher—if the station managers realized that canvassing for current is quite as profitable and much more satisfactory than canvassing for fixture business. If the British central station put out canvassers for motor load (or whatever load they needed most to fill up load-curve gaps) instead of going into the fixture and wiring business when contractors failed to give satisfaction, there would not be so much opportunity for complaint as to the backwardness of the electrical industry in England.

There is in no case, I was told, an active interest, on the part of the central stations, in the work of contractors. The central station does not, as is often done in America, organize the contractors for mutual self-protection and for promoting the interests of the central station. The contractor is either let severely alone or else his functions are usurped by the central station.

The most successful examples of this latter action are those engineered by Mr. A. Hugh Seabrooke, generally considered the most aggressive manager in England. He does not think there is a place at all for the contractor. His theory, which he has put into wide practice in West Ham and St. Marylebone (both districts of London), is that the work of supplying current and apparatus for using that current are so closely related that they logically come under one manager. He holds that the prospective customer is often lost through having to deal with half a dozen different people, securing figures for wiring from one, for current from another, for fixtures and globes from another, etc.

Mr. Seabrooke is a stanch advocate of large investments by the central station in motors and appliances to be put out on the "hire-purchase" (installment) plan or on a straight rental basis. His experience is that such an investment is among the most profitable a central station can make, the annual income sometimes being 80 per cent of the investment. It must be remembered, however, that Mr. Seabrooke has a more ready command of money than most American stations, as his operations have been confined to municipal plants in two wealthy London boroughs.

The success of Mr. Seabrooke has made him a target for the contractors, who have wholly lost sight of the real issue—the wisdom of central-station jobbing—in making their main attack against municipal trading. The controversy now filling the British electrical press is confined mainly to Mr. Seabrooke on one hand and the contractors on the other. The contractor's association bitterly assails Mr. Seabrooke for extending the scope of municipal trading, while he quite properly holds that municipal trading has nothing to do with the merits of the case—that the real question is whether the central station, municipal or otherwise, should do contracting.

The average central station in Great Britain does not agree with Mr. Seabrooke regarding contracting, successful as he is. The usual policy is to let the contractor go his way while the station feels its duty is done when the wheels go round. Edinburgh is an excellent example of the *laissez faire* policy. The load factor in Edinburgh is 17 per cent. The contractors each employ a number of canvassers; the central station has none, as "its prices are sufficient inducement to new customers." Instead of canvassing for power load, which would be comparatively small under any conditions, the price for power has been reduced to a point which only a little more than meets operating cost.

The contractors in Edinburgh devote most of their time and energy to house wiring and fixture business. It comes with least effort and is the most profitable. Meanwhile, the central station is aiming to offset the activities of the contractors, which increase the peak, by giving an unreasonably low power rate, which has not been effective in keeping the gap up to the advances of the peak.

Yet the relations between the contractors and the station in Edinburgh are most friendly. Neither bothers the other, and the central station has no interest in the contractor save to install more generating equipment, as the contractors' energies boost the peak.

The situation is just now prominent before the minds of British engineers. Mr. Seabrooke's plan would undoubtedly be unsuccessful in many places, but it has served to bring the engineers to a realization that the contractors must be more than "friendly" to the stations to bring the best results. They must co-operate, and the ultimate outcome will probably be what it is in America—the employment of canvassers by both central station and contractor, each working along the lines most advantageous to his department, and, by a judicious interchange of influence, straightening out the station load curve as well as giving the contractor a fair profit in proportion to the energy he expends for new business.

NEW TELEPHONE PATENTS.

NEW APPARATUS.

Where the telephone is used in dispatching interurban lines it is usual to distribute connecting devices along the right-of-way by means of which the car telephone of any train may be connected to the dispatcher. These connecting boxes are, of course, located at sidings and at other points from which it is anticipated communication will be necessary. When a car breaks down or becomes stalled between the boxes, unless some special intermediate portable connector be devised, the car telephone must be carried along the line. A patent for such a portable connector has been granted jointly to Messrs. C. H. Hearn and W. H. Feddejohann, of Decatur, Ind. A long hand pole is provided, carrying conductor wires within itself. These terminate in hooks which project from the side of the pole with their openings confronting each other. To use the pole, one hook is placed over one wire and this wire is then drawn toward its mate until the latter may be engaged in the second hook. The lower end of the pole carries terminals to which the lower ends of the conductors are brought out.

An improvement in desk stands has been made by Messrs. E. R. Corwin and C. A. Bals, of Chicago, Ill. Their patent covers improvements in construction of a special design of set, and is assigned to the Corwin Telephone Manufacturing Company. The set has the usual outward appearance, but all parts are secured by spring ribs engaging sockets in the parts. The stand may thus be dismantled without the removing of screws, etc.

SELECTIVE RINGER SYSTEM.

Among the various selective ringing systems which have been in extensive commercial use is that four-party system wherein the bells are polarized and biased and legged from one to the other side of the line to the ground. The ringing is done by spaced impulses of the proper polarity to affect the desired bell. When this system was tried common battery difficulties at once

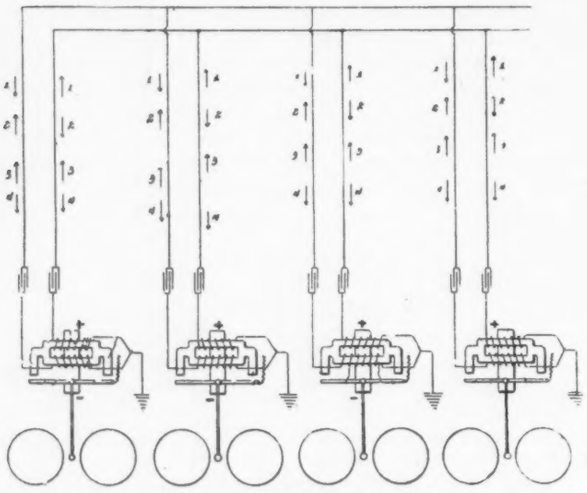


Fig. 1—Welty Ringing Circuits.

arose, due to the bells being conductive. A simple condenser was impossible as a remedy, due to its effect in converting the impulses to an alternating current.

With a view to overcoming all difficulties, Mr. R. C. Welty, of Omaha, Neb., has invented and patented the system shown by conventional diagram in Fig. 1. It will be seen that the cores of the bell coils are so associated that the operation of any bell depends upon the formation of consequent poles. The energization of one winding is therefore of no effect. Neither is an assisting magnetization of the cores. One winding is legged from each side of the line to ground, and each has a condenser in series. By observing the windings of the various ringers, it will be noted that they are shown of different direction about their cores.

The operating currents are obtained from a series of commutators driven in positive relation from the shaft. The key to the system lies in producing condenser charges and discharges in the proper fixed relation.

For example, suppose one ringer to require simultaneous positive impulses for its operation. The first such impulse starts the bell. The condensers are next successively short-circuited, so that the discharge from one does not take place until the discharge of the other is complete. Thus but one core at a time receives discharging energization, and thus without effect. During this period the bias spring has caused the return of the armature ready for the next pair of simultaneous impulses. Simultaneous negative impulses applied similarly are effective at station No. 2, and reversed impulses affect the other two stations.

PORTABLE TELEPHONE.

Mr. O. L. Mulot, of Brooklyn, N. Y., has provided a portable telephone the wiring of which may be attached to a plug. It is self-contained, and may be carried around from place to place on the premises and plugged in on the telephone line by use of a suitable receptacle. The telephone takes the form of a desk-stand set with a base enlarged to take the ringer. The tubular stem carries the induction coil concealed within it.

ILLUMINATED DIALS FOR AUTOMATIC SYSTEMS.

Mr. R. B. Hallock, of Portland, Ore., has patented an illuminated dial system for the senders of automatic stations. The dial is translucent and the lamp concealed in a recess behind it receives current from the telephone line. The lamp may be turned on in advance and will give sufficient light to enable one to look up numbers, etc.

AUTOMATIC LISTENING CIRCUITS.

It has been customary in manual exchanges to provide a listening key for each cord pair. If, then, an operator requires the connection of her talking set with any subscriber it is necessary to plug into that line with one of her cord pairs and then connect in her set by manipulating the corresponding listening key. In order to expedite this process, Mr. W. A. Wynne, of Raleigh, N. C., has patented an automatic listening circuit. He has covered two applications, each described in its own patent.

In one of these a relay is associated with the pilot lamp circuit of a group of incoming lines, so that the illumination of this pilot is accompanied by the immediate connection of the operator's set. This is accomplished through a relay which controls the connection through its contacts. As soon as a plug is inserted in response to the call, the listening connection is cut off. In the second arrangement the automatic connecting relay is in the cord circuit and is so associated with the signal circuits of the cords that if a cord be connected to any line by a single momentary depression of his hook, a subscriber may connect himself to the operator's set. The listening relay in this case locks until released by the operator by means of a release key when her disconnection from the circuit is required.

ACCESSORIES FOR INSTRUMENTS.

In Fig. 2 is shown a new form of transmitter mouthpiece invented by Mr. J. A. Jamieson, of Harrison, N. J. The trumpet is open at both ends and a lateral passage admits sound to the transmitter.

An antiseptic transmitter mouthpiece has been patented by Mr. M. Y. Calcutt, of Seattle, Wash. The usual mouthpiece is removed and there is secured in its place a plate which carries a cover. Both plate and cover are of practically the same

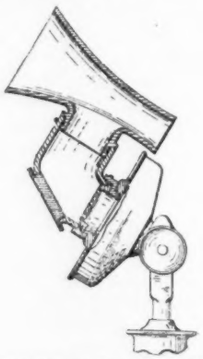


Fig. 2—Jamieson Transmitter Mouthpiece.

diameter as the transmitter. The cover carries a belt pad on its face which may be saturated with antiseptic. This serves to sterilize the transmitter when the mouthpiece is closed.

Mr. W. J. Mogridge, of Spokane, Wash., has patented a receiver support. This is of metal straps. The support clamps upon the transmitter head. The arm moves about an axis parallel to the transmitter axis and as the arm swings the receiver is transferred from one ear to the other.

Letters to the Editor.

Paralleling Gas-Engine Alternators.

To the Editor of Electrical World:

Sir:—In an article on dampers which appeared in your issue of Sept. 30 the writer ventured to say that the discussion of the paralleling of alternations is still full of strange speech and general disagreement, and he might have extended the statement to include the altogether fascinating subject of the parallel operation of gas-engine driven alternators. I see, however, by Mr. L. C. Marburg's letter in the *Electrical World* of Oct. 21 that the subject has been settled scientifically once for all, and we are to expect no further progress in this direction. While this may be doubtless quite true as regards Mr. Marburg's en-

gine, fortunately for the gaiety of nations and the hopes of the engineering public, neither the designers of the Westinghouse nor the Bethlehem Steel companies' engines agree with him. To quote from his letter: "The hunting of gas-engine driven alternators has been reduced to a minimum by using a stable rather than a 'prompt' governor, i.e., by carefully avoiding the remedy suggested by Mr. Miller."

"Suggested" is good. Both the Westinghouse and Bethlehem engines have *always* owed their success in paralleling to having a prompt governing apparatus, which is the essential feature of their method of control. The promptest governor known is the Rites flywheel engine governor, which follows instantly and absolutely any variation whatever in speed. No one can deny that the paralleling of high-speed steam-engine-driven alternators is beyond criticism. The running is as steady and orderly as the best direct-current plants, with positively no cross-currents or swinging of the switchboard instrument needles.

Let us not mistake terms. By a "prompt" governor is meant one that loses no time in readjusting the admission of gas or steam to suit changes of the load. It does this instantly and constantly, the slightest change in rotative speed causing the flywheel governor to gain or lose on the flywheel and thus readjust the cut-off. It follows closely all the minute variations in speed imposed by the small variations of the load. By a "stable" governor is meant one that, while it may not be instantaneous in following the load, at least has no tendency to overtravel it. In the case of Corliss engines in parallel it is often necessary to put on a dash-pot or other retarding device to prevent the centrifugal governor from overtraveling. It is thus slow to recognize changes of load, but at least it does not overtravel and set up hunting.

Now, in the highly diverting letter of Mr. Marburg, I fear there has been a typographical error in describing his governor as "stable." There should be a "d" on the end of it. If his engine be examined for high heat-unit gases it will be found that the governor has little to do with the parallel running because all it does is to control a central butterfly, from which there are about 15 ft. of large pipe each way to the inlets of the cylinders. All the gas in these pipes must be used up before any change made by the governor is even felt by the engine. The governor is so "stable" it is "stabled," so to speak. A logical improvement on its position would be to put the governor out at the gasometer and drive it with an induction motor. It may also account for another sentence in this remarkable letter saying that "the type of valve gear adopted has nothing whatever to do with parallel operation." It was for just reasons like that that the Standard Oil Company, for one, would have nothing to do with this type of engine on oil-distillate gas. When engines governed like that were used, they blew off several tons of valve bonnets, which went soaring serenely through two brick walls and disturbed the calm of the machine shop operators.

PARIS, FRANCE. WARREN H. MILLER.

Patent Office Reform.

To the Editor of Electrical World:

SIR:—Referring to the communications in your issues of Dec. 9 and 23 by Mr. Ludwig Gutmann and Mr. Alfred Muller, respectively, in relation to "Patent Reform in Engineering Societies," I enclose herewith a copy of a letter written by me to President Roosevelt, under date of Sept. 23, 1903, which letter, I may state, I have reason now to believe Mr. Roosevelt never saw. May I, therefore, ask if, in view of the situation which is reflected in the communications of Mr. Gutmann and Mr. Muller, you will present this letter to the public through your columns, as it has never been published.

With relation to Mr. Muller's suggestion that the engineering societies should use their influence toward having the United States patent laws modified, I regret to say that his letter, as well as that of Mr. Gutmann, tends to confirm the suspicion that many have for a long time entertained, namely, that some of our engineering and technical societies are, directly or indirectly, influenced by ulterior interests, and the opinions of members thereof suppressed or censorized when not in accord with the engineering or commercial policies of such interests. It is perhaps needless to point out that this is an absolute perversion of the fundamental object of such societies which, according to their constitutions, is to promote the progress of science and the useful arts; and that such a condition will lead inevitably to the loss on the part of the societies of all prestige and influence with the public.

For over 30 years the courts have had to construe existing patent laws in such a manner as to protect inventors, so far as they can, from the filching of their inventions, and during that period no President of the United States has ever offered any suggestion which in any way would aid the inventor in maintaining his property rights. It is to be most sincerely hoped that this neglect of what has been one of the most valuable personal factors in national development will not continue, and that the sacrifice of the individual inventor at the altar of modern industrialism will not be accepted by the ruling element in government as a necessary concomitant of present-day manufacturing conditions.

NEW YORK. CHARLES J. KINTNER.

Following is the letter of Mr. Kintner to President Roosevelt:

As the time approaches for your annual message to Congress I want to say a few words in behalf of the American Patent Office.

No wiser provision was made in that great instrument—the Federal Constitution—than that providing for the protection of authors and inventors for limited terms in their writings and inventions, and nothing has done more to put the American people upon their high plane of civilization to-day than the American patent system. It is somewhat remarkable that the American public and the American press do not fully appreciate the real value attributable to their patent system, and that officers high in the public service, as a rule, are often equally ignorant upon this subject.

An examination of your last annual message to Congress discloses the fact that while you have gone minutely into details as to the causes of our national advancement, you have left out of the entire list that which, in the opinion of many, is the most potent, namely, the American patent system and its stimulation to inventive genius. The American inventors are to-day the most grossly neglected class of people of any who are entitled to a hearing on the part of our representatives in Congress. You and the public are apparently accepting in common the benefits which accrue from the brains of these inventors as the necessary result of American ingenuity, attributing that ingenuity to the "go ahead" or "push" of the American people and not to the primary cause—the hope of reward which results from exclusive protection by a patent granted by the Government. You and they are using their inventions, enjoying the beneficial results therefrom, and are not awarding them, even by way of legislation, a fractional part of the returns to which they are so justly entitled. Do you imagine for a moment that there would ever have been a Whitney, a Howe, a Morse, a Bell, an Edison or a Marconi to bring forth their inventions but for the ultimate hope of lucrative returns, based upon Governmental protection guaranteed by the Constitution, Article 1, Section 8, Paragraph 8? While wonderful progress has been made in the arts and sciences and in business methods during the last half century, as indicated in your message, the American patent laws have remained practically at a standstill since 1836. Absolutely no change has been made by way of legislation which would in any way give the inventor full protection for his products. On the contrary, corporations have grown up in the nature of trusts which seize the inventions of poor inventors in spite of their patents, employing corps of experts skilled in patent law and technical topics and with the bravado of highwaymen threaten the inventor with interminable

law suits, so that it has now become a stereotyped expression that "To buy a patent is to buy a law suit."

These wealthy trusts are not only enabled, by reason of their wealth and their corps of experts, practically to invalidate or render worthless a real or valid patent which is granted to a poor inventor, but they oftentimes obtain for their own use, as a menace, patents upon inventions which are known by those skilled in the arts to which they relate to be absolutely invalid. I have in mind a case in point in which an application was filed for a patent during my incumbency as principal examiner of the class of electricity in the Patent Office, covering broadly the art of electric railways, which application was bought during its pendency, presumably for a nominal sum, by one of the largest electrical corporations in this country. This application was refused by me and by all of the tribunals of the Patent Office as being for an alleged invention absolutely without novelty. Various hearings were had before the tribunals of the Patent Office and it was always refused. A final appeal was taken to the Court of Appeals of the District of Columbia, where it was argued by the best expert talent on the part of the corporation that could be had, and from an ex parte standpoint only, in so far as electrical expert skill is concerned. That court granted the patent. Suit was afterward brought upon it against a corporation having the means to defend it, and the patent was declared invalid, under conditions, of course, where proper expert talent could be heard on both sides. This corporation still holds this patent and even though it had been invalidated, it is not void because there is no provision in the law for rendering it void, and it is within the power of the corporation to bring suit at any time against a weak infringer and either force him to disgorge, or, in any event, to incur a certain amount of expense in defending his rights. Imagine, if you can, an appeal in reverse order from the Supreme Court of the United States, the most eminent legal experts in the country, upon some intricate question of international law, to some one of the county courts in one of the States, and you will understand this absurd course of appeal—from one, in the first instance (the examiner), who is the acknowledged expert in an art upon technical matters, to a tribunal, in the last instance, which is necessarily without general technical information; moreover, such an appeal upon patent matters is always heard ex parte, except in the appeal to the Court of Appeals of the District of Columbia, where it is argued on behalf of the Commissioner of Patents by one of his clerks, he not necessarily being an expert in any of the arts and certainly not such an expert as an applicant will always interest in such an appeal.

I write you concerning these matters in the hope that, in the light of your great knowledge of trusts and business advancements, you may take an interest in the Patent Office and in the situation of the inventors of to-day. The United States Patent Office embraces an examining corps of about 200 examiners, not one of whom, I think I may safely say, is an expert abreast of the art which he represents, for the simple reason that the Government does not put in the hands of the members of the examining corps such tools as enable them to be experts of a first-class order. It has a scientific library of about 50,000 volumes cooped up in a room utterly insufficient and with a library corps having small facilities for proper classification and the arrangement of data which would enable an expert examining corps to arrive at the best history of the arts.

The entire bureau is under the supervision of the Secretary of the Interior, a politician, as a rule, who cares little or nothing for the interests it represents. The Patent Office building, originally built exclusively for the Patent Office, is occupied by the Interior Department, and the Patent Office proper enjoys less than one-third of the room available in that building—the Interior Department always selecting the choice rooms. All of the supplies furnished to the Patent Office come through the supply division of the Interior Department. If the Patent Bureau desires any increase of force or any increase of room it has been necessary heretofore for the Commissioner of Patents and his assistant to go directly upon the floor of Congress and lobby—so to speak—such requests to a successful end.

The receipts of the Patent Office, over and above expenses, from inventors average about $100,000 per year, until an accumulation of over $5,125,000 is found in the Treasury. The members of the examining corps are so poorly paid that after an examiner becomes a competent expert he is called to the outside as the representative of some particular commercial branch for which his expert knowledge fits him, thus making it apparent that the outside public will pay more for good expert services than the Government is willing to pay.

A model patent system abreast of the times would, in my opinion, place in the hands of the inventor, when the patent is obtained, an instrument which would not be, as now, a *prima facie* patent, but a valid patent only to be overturned by a court of record issuing a decree based upon an undoubted state of facts. It would place it in his power also to use the courts of the United States without expense to protect his rights, and also the rights of the Government, for the reason that if his right is a patent it is necessarily an exclusive right, and being an exclusive right granted by a sovereign power it is the duty of that power to protect it until it be shown by a defendant that the right is wrongfully placed. It would give to the patentee the right to demand of an infringer a bond of indemnity in a stated sum to secure him, in the event of a judgment in his favor. It would require the patentee or his legal representatives to give a bond of indemnity to the amount of the costs incurred by a defendant in a suit based upon the patent, in the event of its being declared invalid. It would render the patent not voidable as now, but actually void. It would take away from the Interior Department the Bureau of the Patent Office and place it under the control of the Commissioner of Patents, whose tenure of office would be for life and whose abilities, both in a legal and an expert sense, would be unquestionable, and not put it within the power of persons seeking individual advancement in a professional way to obtain the position of Commissioner of Patents for a limited tenure.

Such a system would cause the grandest advancement in the arts and sciences that the world ever knew, because the American patent system in its inception is based upon the theory that the Government will give to an inventor a limited exclusive monopoly for something which he will give to the Government at the end of the term of his patent, and not a mere parchment document as now, which is of no value to him, or to anyone in many instances, until thousands of dollars have been expended in litigation.

These statements which I have advanced are based upon facts gleaned by my 20 years' experience as an assistant examiner in the Patent Office; as chief clerk of that bureau; afterward as principal examiner in charge of the class of electricity, and subsequently as a practising solicitor and expert in patent matters. I want to impress upon you at this time the importance of *weaning* the Patent Office from the Interior Department and of establishing a Patent Office bureau in which the officials shall have a life tenure and in which the members of the examining corps shall have all of the advantages afforded by the published arts and by way of machine shops, etc., with a view to making them what the Government experts should be—the very best experts in the world.

Our army and navy experts are not excelled anywhere. Our technical corps of experts in the Geological, Geographical and Coast surveys are the equals of those found in any civilized Government. It is not, therefore, the duty of Congress to place this, the highest bureau of technical information in the world, on a footing which cannot be excelled?

If you have any doubt as to what the Patent Office and the American patent system has done for the public I wish you would turn to the early annual reports of the Commissioners of Patents, particularly Commissioner of Patents Burke, 1847 and 1848, and Commissioner of Patents Fisher, 1869 and 1870. You are accredited with being somewhat of a bookworm, and I feel sure it would repay you to delve into these old reports, which are replete with valuable information concerning not only the times when they were written, but the future of this great country.

I also wish to refer you to Lord Rosebery's speech made in Birmingham, England, some years ago, in which he said: "Let

our Government give us American patent laws. Let us encourage inventors to stay at home. We need all the brains we can get hold of; don't let America drain away much of our best."

I also wish to direct your attention to the fact that a representative of the Government of Japan recently visited this country with especial instructions to examine into the United States patent system and report at length as to the method of procedure of obtaining patents upon inventions and of fostering the patent industry. To this end he visited the Patent Office, examined in detail every division and questioned closely the entire method of procedure in connection with the granting of United States patents. When asked by one of the Patent Office officials why he was doing this, he replied that his Government, having been at a loss to know why the American people had taken such an advanced position among the Governments of the world, had finally decided that this Government offered to the inventor a temptation to invent and protected him in his rights for limited terms, when he did invent, putting little impediment in the way in the nature of fees and other obstructions; while other Governments, such as exist upon the European continent, tended rather to tax inventors.

You will pardon this lengthy letter, but I feel quite sure that the interests at stake in this matter are of such a nature that you cannot fail to see the importance of a thorough revision of our patent laws, particularly in view of the fact that Germany has, within the last few years, become fully cognizant of the weakness, not of our basic system, but of its shortcomings under the present advanced state of civilization; and while fully appreciating the fact that the essential principles of our patent laws are correct, nevertheless recognizing that they should be materially modified to adapt them for the great advancement of to-day.

SEPT. 23, 1903. CHARLES J. KINTNER.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Automatic Regulation of Alternators.—M. SEIDNER.—The conclusion of his long illustrated serial giving brief critical descriptions of a large number of voltage regulators for alternators. He concludes that most of these are unsatisfactory, while a few may be used for regulating alternators and synchronous motors or may at least be further developed.—*Elek. Zeit.*, Dec. 23.

Testing.—E. F. COLLINS.—In a continuation of his serial on commercial electric testing of machinery, the author deals with heating tests and equivalent load tests.—*Gen. Elec. Rev.*, January.

Lamps and Lighting.

Flame-Arc Lamps.—O. GUALERZI AND P. HEYCK.—Two letters. The former author refers to the fact established by Heyck that the specific energy consumption of an alternating-current flame-arc lamp is smaller if an induction coil is in series with the lamp instead of a non-inductive resistor. This saving is due not only to a smaller energy consumption in the induction coil, but also to an increase in the candle-power of the lamp, which is partially caused by the changed form of the voltage curve of the arc. Gualerzi suggests that another reason may be a greater energy consumption in the arc itself. This suggestion is confirmed by Heyck, who gives figures showing that the energy consumption in the arc itself is some 5 per cent to 10 per cent higher when an induction coil is used in series with the lamp instead of a non-inductive resistor, while the total energy consumption is less.—*Elek. Zeit.*, Dec. 23.

Arc Lamp.—H. LUX.—An illustrated description of the Beck arc lamp, which is the first lamp without any regulating mechanism. The uniformity and steadiness of the light is obtained by the use of variators (iron resistors in a hydrogen atmosphere) in series with the lamp. The author describes the operation of the lamp and gives photometric curves of the light distribution. The chief results of his tests are as follows:

	Without globe.	With a clear glass globe.
Mean voltage at terminals	43.9	45.1
Mean amperes	9.98	10.2
Mean watts	438	459
Mean spherical candle-power in hefner candle-power	1390	1474
Mean lower hemispherical candle-power in hefner candle-power	2670	2827
Specific consumption in watts per mean spherical candle-power	0.317	0.315
Specific consumption in watts per mean lower hemispherical candle-power	0.1635	0.1621

It seems anomalous that there is almost no absorption in the globe, but this is explained by the fact that with the globe there are certain unavoidable reflections which result in an apparent increase of the candle-power.—*Zeit. f. Beleucht.*, Dec. 20.

Arc-Lamp Electrodes.—I. LADOFF.—A continuation of his article giving brief descriptions of use made by various inventors of electrolytic substances (conductors of the second class) for arc-lamp electrodes.—*La Lumière Elec.*, Dec. 18.

Metallic Filament.—A note on a recent British patent of C. T. Fuller (17,619, 1908; Dec. 16, 1909). The yellow trioxide of tungsten is mixed with an aqueous binding agent containing 25 per cent cornstarch. Filaments squirted from the mixture are reduced in an electrically heated graphite tube with a protective covering of coke. The carbon boats containing the filaments are lined and covered with rutile (TiO_2) or powdered tungsten, either of which protects the filaments from carbon vapor without sticking to them, while it allows the carbon monoxide to escape. A stream of hydrogen is maintained throughout the tube.—Lond. *Elec. Eng'ing*, Dec. 23.

Metallic-Filament Lamp.—A note on a recent British patent (2389, Dec. 16, 1909) of the British Thomson-Houston Company (General Electric Company of this country). The squirted filaments are attached to clamps on an endless band which passes through a long chamber supplied with the treating gases. Current is supplied through brushes and contact rails, and caused to increase gradually and automatically as the filaments pass along into the end at which the pure gases are led in.—Lond. *Elec. Eng'ing*, Dec. 23.

Metallic-Filament Lamp.—A note on a recent British patent of R. Hopfelt (8146, Dec. 16, 1909). The squirted filaments are brought to incandescence in an atmosphere of a halogen compound, such as arsenic trichloride or phosphorous trichloride. This not only sinters the filaments, but removes all hydrocarbons. Carbon filaments can be treated in the same way at a lower temperature.—Lond. *Elec. Eng'ing*, Dec. 23.

Metallic-Filament Lamps.—B. DUSCHNITZ.—An article illustrated by diagrams in which the author reviews recent progress in the arrangement and mounting of the metallic filament in the globe.—*Elek. Anz.*, Dec. 3.

Photometric Tests.—An account of tests of various lamps carried out at the Reichsanstalt in 1908. Metallic-filament lamps have done better than last year. In one series of 24 lamps for 234 volts alternating current 15 lamps remained useful after 2000 hours. In another series of 24 lamps, 12 lamps at 120 volts and 12 at 220 volts, both for alternating currents, half of the lamps were suspended vertically, the others at 45 deg.; the latter set had a longer life, for some unexplained reason. Mercury-quartz lamps gave great satisfaction. The flicker photometer is not particularly recommended by the Reichsanstalt. The rotating sector, it is pointed out, cannot be used, and there is no advantage as regards testing sources of light of different colors because persons differing as to their sensitiveness to graduations of brightness are differently af-

fected by the flicker and the ordinary equality or contrast tests. —Lond. *Engineering*, Dec. 17.

Flicker Photometer.—H. Morris-Airey.—An article of a physiological nature on the use of the flicker photometer for differently colored lights. The chief conclusion of the author is that the conditions under which the retina is excited during a measurement with the flicker type of photometer are not the practical conditions of illumination to which it is the object to apply the data obtained from the experiment.—Lond. *Electrician*, Dec. 17.

Generation, Transmission and Distribution.

Mixed Fuel.—A. S. Mann.—An article on making steam with mixed fuel, reporting the results obtained in practice by mixing hard coal and soft coal in various proportions. The results of some tests are shown in Fig. 1. They give the fuel cost per 1000 lb. of steam with various fuel mixtures. The

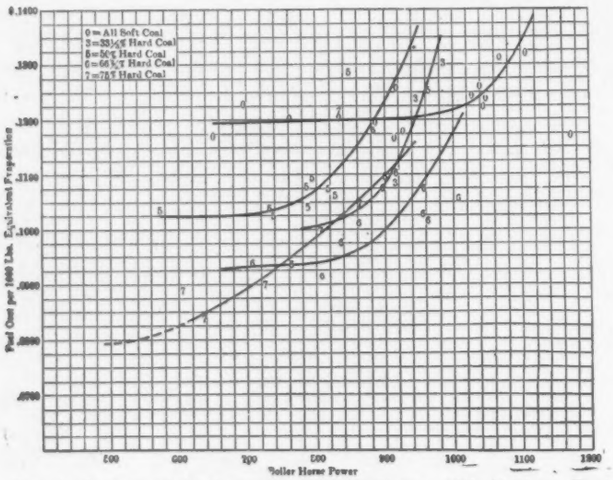


Fig. 1—Curves of Cost per 1000 lb. of Steam with Various Fuel Mixtures.

curves show that it is possible to develop more horse-power —that is, to carry greater load—by decreasing the hard-coal proportion, even excluding it altogether for loads exceeding 1000 hp. For loads up to 1000 hp, or 167 per cent of rating, a mixture consisting of two-thirds cheap hard coal will give lower fuel costs than will the clear soft coal; and the fuel cost for all soft coal advances rapidly after passing the load of 1000 hp. In any event, the best way to carry a load is to select the coal mixture suited for the load at hand and to change proportions of fuel when the load changes.—*Eng. Mag.*, January.

Water-Power Plant in Asia.—H. P. Gibbs.—An illustrated description of the water-power plant making use of the Cauvery Falls and supplying electrical energy to various mining companies on the Kolar gold field in India. This is the first important hydroelectric development in Southern Asia. There are 11 720-kw and one 1500-kw generators, the e.m.f. generated being 2200 volts. For transmission the e.m.f. is raised to 35,000 volts.—*Gen. Elec. Rev.*, January.

Traction.

Destruction of Gas and Water Pipes by Stray Currents of Tramways.—F. Haber and P. E. Krasse.—The authors have formerly investigated this subject in great detail and now report some supplementary observations. In Karlsruhe in that district, which had formerly been found to be the danger zone, further destruction has occurred. Current densities of 1 milliamp per square decimeter or more have been observed, and the e.m.f. between rail and pipe was found above 1 volt. Under the conditions which exist in Karlsruhe (resistivity of the earth about 2000 ohms per cubic meter), there is danger when the e.m.f. between pipe and rail is 1 volt or more, but under different conditions, where the earth is a better conductor, lower voltages can become dangerous. The authors give some theoretical considerations and discuss the occurrence of earth currents, when there is no tramway in the neighborhood. Such earth currents are formed when the pipes consist of different material (cast iron and wrought iron), or when two points of the surface of the pipes are under different conditions, the earth representing the electrolyte. The effects of the presence of oxygen in the earth is also considered.—*Zeit. f. Electrochemie*, Sept. 15.

Installations, Systems and Appliances.

Electrical Industry in the United States and Germany.—W. Fellenberg.—The conclusion of the author's long serial on the development of the electrical industries in the United States and Germany. In the present instalment statistical data are given on the development of the central stations in the United States. In summing up the author says that the number of central stations, as well as their rating, is larger in the United States than in Germany, both absolutely and relatively (per number of inhabitants). With respect to isolated plants, Germany is ahead of the United States. In the time from 1902 to 1907 the percentage increase of the number of central stations was larger in Germany than in the United States. But the increase of rating was much less. With respect to municipal ownership there is a tendency in Germany to have the central stations operated by the municipality, but this has been found to retard progress, and it is recommended to urge the private ownership of central stations, especially for the sake of large transmission systems, which could not be undertaken by a small municipality. The comparison of the capital invested shows that small central stations are built more expensively in Germany than in the United States, but large central stations more cheaply. This is believed to be due to the fact that all regulations of the association are enforced in Germany, even for small stations. A comparison of the operating cost and load factor shows that in spite of their poorer load factor the German central stations are ahead of those in the United States with respect to cost of operation.—*Elek. Zeit.*, Dec. 23.

Metallic-Filament Lamps and Central Stations.—G. Wilkinson and R. McCourt.—A paper read before the Leeds Section of the (Brit.) Inst. Elec. Eng. on the effect which the introduction of metallic-filament lamps has had on the Harrogate central station, where the bulk of the demand on the station is for lighting purposes, and where the supply is alternating current, conditions which admittedly favored the largest possible use of the new lamps in the shortest possible time. In street lighting the high-candle-power metallic-filament lamp has been substituted to a large extent for arc lamps and has proved very satisfactory. Moreover, smaller metallic-filament lamps have been found to be most effective competitors against incandescent gas lamps in side-street lighting. Private consumers have adopted the metallic-filament lamps very quickly. There have been sold from 30,000 to 40,000 metallic-filament lamps. In the business district this has resulted not so much in a reduction of the number of annual kw-hours as in a general increase of illumination. In houses, however, the consumption of energy has decreased; for instance, in a hotel which formerly used 13,712 kw-hours in a year, only 7672 kw-hours were used last year. Nevertheless, it was decided not to raise the price per kw-hour, but rather to educate the public to appreciate the economy and possibilities of the new lamps. This has resulted in getting new consumers and the number of kw-hours sold for lighting purposes for the year ending March, 1909, is only 5 per cent below the figure for the year ending March, 1908, and the figures for kw-hours sold for all purposes are less by only 2.5 per cent. For small consumers a contract system of charging has been arranged without a meter, but with a current-limit indicator, which is of a simple thermal type, compensated for variation in atmospheric temperature, the cost being less than half that of a reliable meter.—Lond. *Electrician*, Dec. 17.

Automatic Circuit-Breaker.—Henry.—An article illustrated by diagrams describing the different types of relays used with automatic overload, or underload, or reverse-power, or no-current circuit-breakers.—*L'Industrie Elec.*, Dec. 10.

Power-Factor Regulators.—H. A. Laycock.—An illustrated description of two types of power-factor regulators for use in

connection with synchronous motors.—*Gen. Elec. Rev.*, January.

Inspection of Plants.—F. DREXLER.—An article on inspection of electric plants for insurance purposes and on various shortcomings which are often found in such inspections.—*Elek. und Masch.* (Vienna), Dec. 19.

Regulations.—G. STIER.—An account and discussion of the new regulations which have gone in force in Germany with the beginning of this year for the protection of working women and children.—*Elek. Zeit.*, Dec. 23.

Wires, Wiring and Conduits.

Fuses.—W. KLEMENT.—An article on the standardization of enclosed fuses, profusely illustrated by diagrams.—*Elek. Zeit.*, Dec. 23.

Electrochemistry and Batteries.

Conservation and the Chemical Engineer.—S. P. SADTLER.—A paper pointing out that the development of natural resources comprises three stages: exploration or discovery, exploitation, and conservation. Our present methods of exploitation are exceedingly wasteful, and it is one of the chief problems of the chemical and metallurgical engineer not only to develop methods of exploitation, but to devise means of conservation, so as to avoid unnecessary waste. Instances are given from the petroleum industry, coal distillation, and the fixation of atmospheric nitrogen.—*Met. and Chem. Engineering*, January.

Study of Electrolysis by the Ultramicroscope.—J. J. KOSSONOGOW.—An account of an experimental investigation of the Brownian movements in electrolytes during electrolysis by means of the ultramicroscope. The author seems to think that the particles, the movements of which he observes, may be the ions. The determination of the decomposition voltage can be easily done by means of an ultramicroscope, as the phenomena observed are very characteristic. The method seems to offer new possibilities for the study of electrolysis.—*Phys. Zeit.*, Dec. 15.

Dry Cells.—In the report of the Reichsanstalt for 1908 it is stated that the number of dry cells submitted for commercial testing has much increased and the intermittent tests are now, both by the Reichsanstalt and by the German Postal Department, carried down to 0.7 (instead of 0.8) volt; in some cases a demand is made for continuous tests down to 0.4 volt. The quality of the manganese dioxide (depolarizer) is of considerable influence. Of two Laclanche cells, the one *a* gave much better curves than *b*; it was found that in *a* 60 per cent of the oxygen had really been consumed for oxidation; in *b* only 35 per cent, which tends to show that not all the available oxygen is really reducible in the cell. The fact was to be foreseen, but the point requires further investigation.—Lond. *Engineering*, Dec. 17.

Electric Smelting of Copper Ores.—S. B. LADD.—An article in which the author suggests the use of electric heat as an accessory to blast-furnace and reverberatory-furnace smelting, the electric energy being employed for supplying the higher temperatures, while the fuel heats the charge to such a temperature that electric heating may be economically employed for the rest.—*Met. and Chem. Engineering*, January.

Electric Iron-Ore Reduction.—L. YUNGSTROM.—A long and fully illustrated report of the results obtained with the electric shaft furnace for the reduction of iron ore at Domnarfvet, in Sweden, giving diagrams of the evolution of the design of shaft furnace used, and details of the results obtained.—*Met. and Chem. Engineering*, January.

Aluminum.—P. ROLAND.—The first part of an article on the properties of aluminum and its industrial applications for electric transmission lines, in steel metallurgy, the use of aluminum films or leaves, aluminum tubes, etc.—*La Lumière Elec.*, Dec. 18.

Units, Measurements and Instruments.

Measuring Weak Alternating-Currents with Thermo-Couples.—In the report of the Reichsanstalt for 1908 it is mentioned that for the measurement of weak alternating currents by means of thermo-couples, the bridge arrangement of Salomonson has been made use of. It was found that this method gave slightly higher values for direct-commutated currents than for alternating currents. The cause of this discrepancy has now been explained by Schering. It was noticed that each thermo-couple of manganin constantan showed a discrepancy of its own, which seemed to depend upon the extension of the solder at the junction. The discrepancy was greatest with tin solder. When the wires, 20μ in diameter, were soldered end to end with a trace of silver, the discrepancy was smaller; when the wires were merely twisted together without soldering, there was no discrepancy, but the results were variable, owing to the variable contact resistances. With thicker wires, the end-to-end soldering proved even more successful; but, on smearing a little tin on the wires near the junction, the old discrepancy was at once noticed again. The following explanation is suggested: Owing to Peltier effects, the thin soldering assumes a higher temperature with the one current direction than with the other, and the soldering forms at the junction a shunt to the wires of a comparatively high temperature-resistance coefficient. This becomes apparent with direct current, for which the resistance relations in the respective arm of the bridge change with the direction of the current, but not with alternating currents, in which the Peltier heat cannot, owing to the rapidity of the changes, affect the temperature of the junction noticeably. If the thermo-electric forces were greater, these minor influences would hardly be perceptible. Fig. 2 shows an arrangement in which the difficulty is avoided. The current passes from the source of energy *Q* through two wires 20μ in thickness, a manganin and a constantan wire joined in parallel. By means of silver a constantan wire is soldered to the middle of the manganin wire at right angles to it, and a manganin wire to

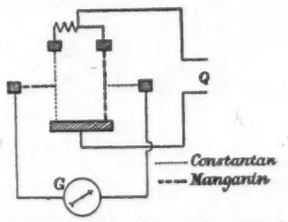


Fig. 2—Arrangement for Measuring Weak Currents.

the constantan branch. These latter wires lead to the galvanometer *G*, and by inserting suitable resistance the current is prevented from passing from manganin to constantan, so that the Peltier effects do not enter. The arrangement records direct currents and alternating currents with equal reliability.—Lond. *Engineering*, Dec. 17.

Thermo-Couples.—In the report of the Reichsanstalt for 1908 it is stated that 691 of the 788 thermo-couples tested were of the Le Chatelier platinum, platinum-rhodium type. The e.m.f. of these couples decreases when the couples are exposed to very high temperatures for many hours, and the whole length of wires of a new couple was, therefore, wound on a magnesia tube, without allowing the two wires to come into contact, and heated to 1400 deg. C. in an electric furnace. Carbon, silicon and iridium, which had been held responsible for the change, were absent in these experiments. It would appear that some of the rhodium evaporates and settles on the platinum wire, causing a change in the e.m.f., which, at the end of four hours, was equivalent to 35 deg. C. This confirms an observation made by W. P. White in 1906, who found rhodium in the originally pure-platinum wire. The effect is local and confined to those portions which are exposed to the highest temperature; that would explain the dependence of the e.m.f. upon the depth to which the couple is inserted. The number of constantan-silver couples tested had diminished, and there is a prejudice against their constancy. Repeated tests, during which such couples were heated for 12 days, finally to 600 deg. C. and 650 deg. C., did not bring out any discrepancy; the indications remained constant within 1 deg. The want of constancy may be due to the arrangement used in technical practice.—Lond. *Engineering*, Dec. 17.

Variable Inductances.—J. A. FLEMING.—In a paper on meas-

urements in connection with radiotelegraphy, the author mentions that flat spirals constitute very convenient forms of inductance, and have been already used in radiotelegraphy. Very convenient forms of variable inductance without sliding contacts can be made with flat spiral coils—for instance, two such spirals may be mounted on hinged boards so as to come more or less into opposition to each other (see Fig. 3). The two spirals can be joined up in series by a flexible connection, so that when the boards are shut up like a book the currents in the two spirals oppose each other, and the joint effect is a minimum inductance. By opening the hinged boards the inductance

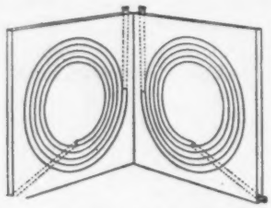


Fig. 3—Folding Book Form of Flat Spiral Inductance Coil.

can be increased in about the ratio of 8 to 1 without altering the total resistance or introducing a rubbing contact. Four spirals may also be mounted on two boards pivoted at the center so as to cross each other, and these four coils may be joined up so that when the upper board is turned round through 180 deg. the inductance varies from a minimum to a maximum value over a considerable range. Such arrangements are useful in tuning coils for radiotelegraphic receivers and transmitters.—Lond. *Electrician*, Dec. 17.

Standards of Capacity.—In the report of the Reichsanstalt for 1908 it is stated that the new air condenser consists of 117 disks of magnalium, 1 mm in thickness, 20 cm in diameter, 1 mm apart, of a capacity of 0.03 microfarad; amber serves as insulator, and the insulation resistance is about 10^{15} ohms. Absolute measurements are made by the methods of Maxwell with the aid of an improved rotating interrupter of Kurlbaum and Jaeger. The centrifugal governor added to this device is illustrated in Fig. 4. A weight P slides on a steel wire S at right angles to the axis of rotation R; the wire S is fixed between the axis and a framing G, and a spiral spring F is attached to the weight P and to an adjustable cross-bar Q of the framing. When P is receding from the axis, the two contacts K_1 K_2 cut out part of the field-circuit resistance of the shunt motor. This governor keeps the speed constant within a few hundred-thousandths, and the constancy is controlled by watching the galvanometer. The temperature of the room must, however, be kept constant, as the spring has a temperature-

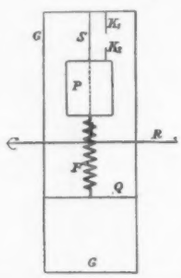


Fig. 4—Diagram of Centrifugal Governor.

flexibility coefficient of a fe r ten-thousandths per degree C.—Lond. *Engineering*, Dec. 17.

Magnetic Tests.—In the report of the Reichsanstalt for 1908 a review is given of various magnetic tests. Certain peculiarities of the yoke method still remain unexplained; on the whole, however, the yoke method is sufficiently accurate, considering that the want of homogeneity in the material generally makes very accurate determination impossible. In the determination of the initial permeability even the ellipsoid method gives discordant results. The examination of a small sample of very pure iron was disappointing, as the material did not prove magnetically superior. Measurements made on six qualities of sheet iron showed that the sheets were magnetically poor when the direction of the flux was at right angles to the direction in which the sheet was rolled, even after annealing, while the influence of the direction of rolling upon the electric conductivity was not marked. Turning and rolling had little influence upon the coercive force of rods; ring stamping soon lost the advantages of annealing in the course of time, the maximum permeability diminishing from 6700 (after two months) down to 4450 (after eight months), while the hysteresis loss increased by 3 per cent. The Geisweider Eisenwerke are experimenting, in conjunction with the Reichsanstalt, on the influence of the temperature and of the wetting during the rolling of dynamo sheets, and Krupp has prepared 15 silicon alloys with a maximum Si percentage of 8.5 for accurate testing.—Lond. *Engineering*, Dec. 17.

Instantaneous Roentgen-Ray Photography.—F. Dessauer.—The author emphasizes the desirability of shortening the time of exposure to Roentgen rays and describes a powerful apparatus which he has devised for this purpose. It consists of a very large induction coil, fed by a strong current which on rising to a proper value is quickly broken by a peculiarly constructed fuse. This fuse is a calibrated piece of wire which is surrounded by a moist covering consisting of a mixture of earths. When the wire heats, the water vapor is formed quickly under pressure and the fuse explodes with violence, thereby breaking the circuit. The author recommends his method to physicians, and has obtained Roentgen cinematographs of the movement of the heart.—*Phys. Zeit.*, Nov. 10; abstracted in *Amer. Jour. of Science*, January.

Meter.—An official communication of the Reichsanstalt by which a magnet motor meter for direct current of J. Busch is admitted for calibration. The construction of the meter is described and illustrated.—*Elek. Zeit.*, Dec. 23.

Telegraphy, Telephony and Signals.

Multiple Telegraphy.—A description of Mercadier's system in which use is made of vibratory currents, the receivers being telephones tuned to respond to one particular note, so that a number of messages can be sent simultaneously over the same line. The device which generates the vibratory currents sent into the line is shown in Fig. 5, where E is an electromagnet mounted in a fixed position between the prongs of a fork. Each of the prongs carries a steel-wire contact piece 1/28 in. in diameter, which is designed to make contact with a platinum plate mounted on an adjusting screw A, which can be regulated

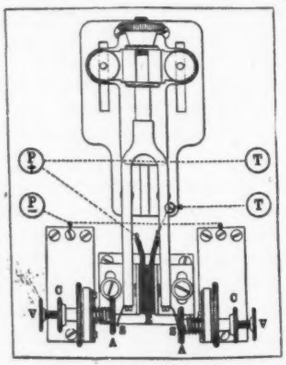


Fig. 5—Vibrating Device.

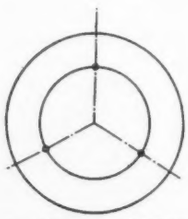


Fig. 6—Diagram of Vibrating Disk.

by the screw device CV. One pole of a battery $P+$ is connected to the electromagnet, and the other pole $P-$ to the metallic mass of the interrupter, while the other end of the magnet is connected to the mass of the tuning fork. When the fork is in the normal position there is a contact between each of the steel points and the corresponding platinum plate, but this causes the current to flow into the electromagnet, attracting both prongs of the fork at the same time, thus causing the fork to vibrate at a definite rate, corresponding, for instance, to the note sol in the musical scale. Owing to the effect of the battery current, there is produced a magnetic field in the elec-

tromagnet core and also in the ends of the prongs lying next to it. When the fork vibrates this causes the distance between the prongs and the iron core to be greater or less, and the magnetic field is alternately increased and diminished thereby. Such a fluctuation of the field reacts upon the wire of the coil and generates in it an undulatory current whose rate of vibration is naturally the same as that of the fork. The receiving instrument is called a mono-telephone. In it use is made of a thin steel disk, which is acted upon like a telephone diaphragm by an electromagnet giving a regular vibrating current. If such a disk is made to rest upon three points lying on the circumference of a circle concentric with the disk (Fig. 6) the diameter of the circle being 0.68 of the total diameter, this circle is the nodal line for the first harmonic of the disk. In this position the disk will give out a sound corresponding to this harmonic and no other.—Lond. *Electrician,* Dec. 17.

Lepel System of Wireless Telegraphy.—W. H. ECCLES AND A. J. MAKOWER.—The system of von Lepel for generating high-frequency oscillations for wireless telegraphy makes use of two parallel-surfaced copper plates (Fig. 7) between which the discharge passes and which worm the opposed faces of the metal boxes B_1, B_2. These boxes are supplied with flowing water by means of rubber pipes, and the discharge surfaces are kept at a correct distance apart by means of one or two paper rings, the thickness of which has to be chosen to suit the supply voltage and the current. For the purpose of wireless signaling this discharger is connected as shown in Fig. 8, in which *I* and *I* represent the choking coils, and *R* and *R* the regulating resistors, and *S* the main switch in the supply leads. The primary oscillating circuit is formed by the inductance *L* and the capacity *C*, and the secondary circuit by the aerial conductor, whose capacity to earth is *K*, the inductances *N* and *L* and the condenser *G*. The last-named path must be tuned by trial to the oscillating circuit *L G C*. The authors have measured the efficiency of this discharger for generating electrical oscillations. The highest over-all efficiency recorded in their experiments is 14.4 per cent.—Lond. *Electrician,* Dec. 17.

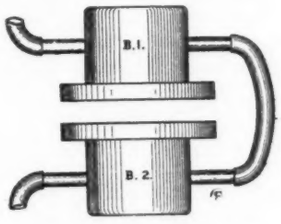


Fig. 7—Oscillator.

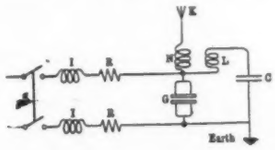


Fig. 8—Diagram of Circuits.

Miscellaneous.

Electric Lighting of Automobiles.—R. E. SCOTT.—An illustrated article in which the author reaches the following conclusions: Electric lighting is an ideal form of illumination for motor vehicles, owing to its brilliancy, convenience and safety. In order to be a success for touring-car work as well as for light runabout work, the electric lamp used must be able to withstand severe shocks to the machine without injury. This desideratum is realized in the anchored-back tungsten filament. For satisfactory illumination results in automobile lighting scientifically designed reflecting devices and fixtures should be used. Well-developed lines of such devices are now commercially available. The tungsten automobile lamp is markedly superior to the carbon lamp in nearly all cases on account of the increased light of superior quality which it gives for a reduced lighting battery equipment.—*The Illum. Eng.,* December.

Magnetic Concentration.—N. V. HANSELL.—An illustrated article on the magnetic concentration of iron ores. After a statement of the principles the author discusses cobbing machines, by separators and wet separators, and describes various industrial separating plants.—*Eng. Mag.,* January.

BOOK REVIEWS.

VEHICLES OF THE AIR. A Popular Exposition of Modern Aeronautics with Working Drawings. By Victor Lougheel. Chicago: The Reilly & Britton Company. 479 pages, illustrated. Price, $2.50.

In the preparation of this volume the author's object has been to produce an adequate, up-to-date and at the same time a comprehensive presentation of what promises to become one of the most important and alluring fields of modern engineering. A practical and popular treatise on aerial navigation has thus far been lacking, and the appearance of this work will therefore be hailed with satisfaction by the steadily increasing number of those who are interested in the subject. The 15 chapters into which the book is mainly divided deal with the atmosphere, lighter-than-air and heavier-than-air machines, aeroplane details, propulsion, power plants, transmission elements, bearings, lubrication, starting and alighting, materials and construction, typical aeroplanes, and accessories. In the concluding chapter a tabulated history of flights is given. The book is freely illustrated by engravings in the text and by a number of half-tone plates showing the various types of aeroplanes and dirigibles.

MOTOR CONTROL. In Connection with Turret-Turning and Gun-Elevation (The Ward Leonard System). By Andrew Olsson, chief gunner, U. S. Navy. New York: D. Van Nostrand Company. 23 pages, illus. and plates.

This is the first of a series of manuals designed by the author to cover various applications of electricity to naval purposes. As stated in the title, the present work is confined to the Ward Leonard system of motor control as applied to turrets and gun-elevation, which applications are treated in minute detail and with reference to a number of excellent diagrams inserted as folders. Notwithstanding the special object of the book, it is of general value through giving a thorough presentation of the Ward Leonard system of motor control, which system has found a wide application in many lines of motor work. To those interested in motor control this monograph will consequently be welcomed as a most desirable addition to the literature of the subject, and particularly on account of the minute detail which characterizes the treatment.

HANDBOOK FOR WIRELESS TELEGRAPH OPERATORS. London: Wyman & Sons. 44 pages. Price, 3d.

The present is a revised edition of a manual for the guidance of wireless telegraph operators on board ship and at coast stations licensed by the British Postmaster-General. An outline is given of the regulation as to power and wave-lengths to be employed. Ship stations must be installed in such a way as to be capable of using a wave-length of 300 m, while land stations can use a wave-length of either 300 m or 600 m. All British coast stations are bound to interchange radiotelegrams with ships without regard to the particular system of telegraphy employed. The obligation to accept messages of distress is absolute in the case of every British ship and coast station without distinction.

The book contains complete instruction for the operators, covering the conditions that may arise in carrying out the above

fundamental regulations. Moreover, much information is given concerning the form and acceptance of radiotelegrams, charges, accounts and reimbursements; procedure to be observed by ship and coast stations in the transmission of radiotelegrams. In appendices are given a form of official list of stations, the international Morse code, list of abbreviations, service advices, and application blanks for operators. The book is official in character, and while it applies strictly only to installations licensed by the British Postmaster-General, yet it should prove of value as a source of information for all wireless telegraph operators.

New Apparatus and Appliances

THE VISALIA (CAL.) 15-CYCLE, SINGLE-PHASE RAILWAY.

The first 15-cycle, single-phase, alternating-current railway in the United States, and the only one at present, is the Visalia Electric Railroad, running from Visalia to Lemon Cove, Cal. The road has been two years in successful operation and has fully justified the confidence of its builders in selecting an untried system of electrification. Although the present length of electrical operation is only 22 miles, the location of the Visalia road is such that it will undoubtedly become an important link in the large electric railway system which seems destined to cover that section of the San Joaquin Valley in the near future.

For a distance of 10 miles between Visalia and Exeter the electric railway traverses the main track of the Southern Pacific Railroad, which has been electrified over this section by the addition of rail bonds, and a 3300-volt trolley circuit. Twelve miles farther, from Exeter to Lemon Cove, a new roadbed has been constructed, making the total length of the Visalia-Lemon Cove electrified route 22 miles. The road is single-tracked throughout with the exception of the switching and freight yards at Visalia, Exeter and Lemon Cove. The trolley construction is of the single catenary type, suspended from brackets on poles spaced 120 ft. apart.

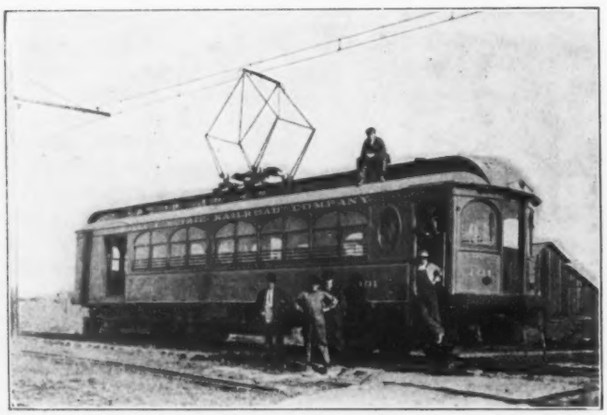


Fig. 1—Single-Phase Interurban Electric Car.

Ground was broken for the Exeter and Lemon Cove extension in March, 1905, and the road was operated by steam locomotives in December, 1905. In March, 1908, the steam service was discontinued, and since then has been operated by electricity.

From Visalia to Exeter the country is practically level. Between Exeter and Lemon Cove the land is of a rolling nature, but the maximum gradient on the road has been kept down to 0.9 per cent and the curves are of long radius. The worst conditions are met on a combined 10-deg. curve on a 0.9 per cent grade.

For this electrification, three-phase, 60-cycle energy is purchased at 35,000 volts from the Mt. Whitney Power Company, which operates a hydroelectric plant on the Keweah River. At the Exeter substation, located nearly at the center of the present railway line, the 60-cycle e.m.f. is stepped down to 2200 volts, and then converted to 15-cycle, 11,000-volt, single-phase e.m.f. by a synchronous motor-generator set. From the main frequency changing substation at Exeter, the 15-cycle, 11,000-volt feeder lines, made up of a pair of No. 4 bare copper conductors, transmit energy eight miles in each direction to the substations on the Lemon Cove and Visalia divisions. Transformers in these stations reduce the trolley pressure or e.m.f. to 3300 volts.

The frequency-changer substation contains six 150-kw, oil-insulated, water-cooled, 35,000-volt to 2200-volt, 60-cycle transformers, and two two-bearing motor generator sets, each composed of a 540-hp synchronous motor wound for 2200 volts, 60 cycles, with induction motor for starting, direct-connected to a 375-kw, rotating field, single-phase alternator, delivering 11,000 volts, 60-cycle current. The 60-cycle incoming transmission line is protected by low-equivalent lightning arresters, complete with oil-insulated choke coils and disconnecting switches. Three 15-kw, 2200-volt to 200-volt, 60-cycle transformers are supplied for lighting service and for operating the motor-generator exciter set. On the extended shafts of each motor-generator set are mounted 125-volt, direct-current generators which furnish excitation current, in addition to a similar direct-current exciter driven by a three-phase, 60-cycle induction motor receiving energy from the incoming transmission lines. The outgoing 11,000-volt, 15-cycle feeder circuits are protected against lightning discharges by complete arrester apparatus, and are controlled by oil switches. The Exeter substation also feeds energy to the trolley wire through two 300-kw, oil-insulated, self-cooling, 15-cycle, single-phase transformers, which reduce the e.m.f. from 11,000 volts to 3300 volts.

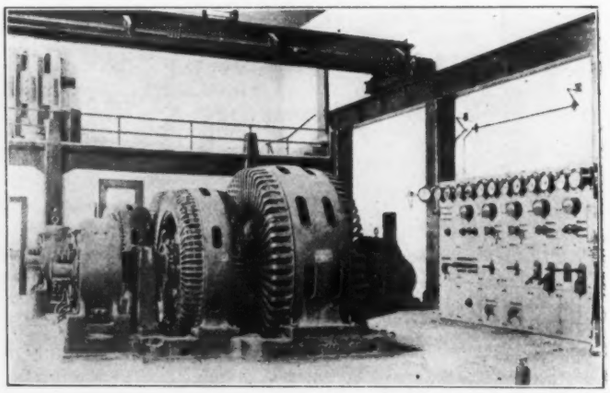


Fig. 2—Interior of Exeter Frequency-Changing Substation.

The two 15-cycle transforming substations, each located about eight miles from Exeter in the direction of Lemon Cove and Visalia, respectively, contain a 300-kw, oil-insulated, water-cooled, 15-cycle, single-phase transformer, reducing the e.m.f. from 11,000 volts to the trolley pressure. Lightning protective apparatus, choke coils, and high-tension circuit-breakers are included in the 11,000-volt apparatus, while the 3300-volt trolley feeders are controlled by oil circuit-breakers.

The 3300-volt, single-phase trolley construction is of the single-catenary bracket type, comprising a 7/16-in. steel messenger cable suspended from poles 120 ft. apart, and supporting

No. 3-0 trolley wire. The redwood poles, 36 ft. long, are set 6 ft. in concrete. The rolling stock comprises a 47-ton Baldwin-Westinghouse electric locomotive, equipped with four 125-hp, series compensated, single-phase motors driving 36-in. wheels through a gear reduction of 17 to 66; four 40-ton passenger cars, each equipped with four 75-hp motors, and two 28-ton trailer cars of construction similar to the motor cars.

All of the cars and locomotives are provided with unit-switch control and automatic air-brake equipment. The trailer cars, as well as the motor cars, are fitted with brake valves and master controllers, so that three-car trains can be operated from a trailer car at the head of the train when desired.

The motor cars and locomotives receive energy through pantograph trolleys, and carry auto-transformers arranged with taps for reducing the trolley pressure to voltages suitable for the motors, car lighting and air compressors. The motor cars have oil-insulated, self-cooled auto-transformers, while that on the locomotive is air-cooled from the motor-driven blower equipment furnished for the forced ventilation of the motors.

The 45-ton electric locomotive is of the double-swivel-truck class. With its four 125-hp motor connected to 36-in. wheels through a gear reduction of 66 to 17, this locomotive is capable

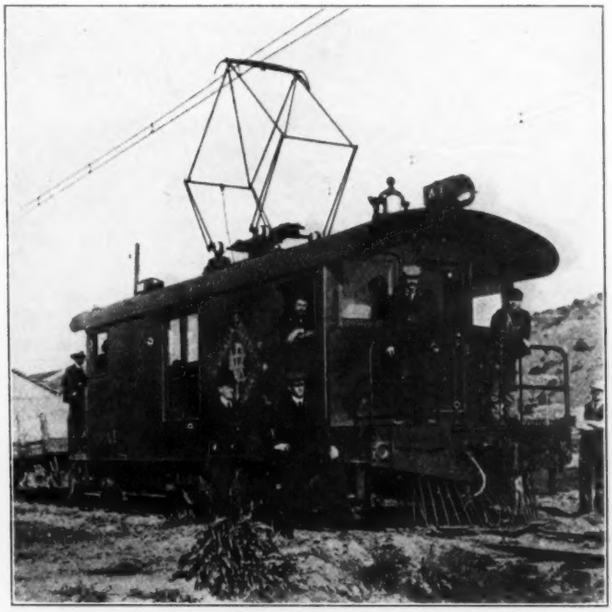


Fig. 3—Fifteen-Cycle Single-Phase Electric Locomotive.

of developing a continuous draw-bar pull of 4500 lb. at 20 miles per hour on level track. The full-load draw-bar pull is 9000 lb. at 17 miles per hour on the level. The maximum starting draw-bar pull is 17,000 lb.

The equipment of each substation was designed to take care of the electric locomotive fully loaded, or one train of two motor-cars and one trailer. In general service, only single motor cars are operated, without trailers, but when crowds are to be handled or the traffic conditions warrant, three-car trains are run. As an operating test, a six-car train has been successfully operated over the entire system.

The maximum regular operating speed is 45 miles per hour, although a single motor car has developed 62 miles per hour. The fast cars of the system run from Visalia to Exeter in 23 minutes, and from Exeter to Lemon Cove in 21 minutes, calling for a schedule speed of 31 miles per hour.

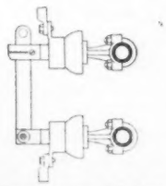
A recent incident provides evidence of the ample tractive force of the locomotive. While doing some switching around the yard at Exeter, in order to get hold of a certain car it was necessary for the electric locomotive to move a string of 40 standard refrigerator cars standing in the way. Twenty-eight of these were loaded, making the total weight of the train 1044 tons, which was handled and switched around the yards by the electric locomotive without difficulty.

The following figures will afford some idea of the economy of operation of the system: During a period of 40 days over which readings were taken, the average energy consumption of the locomotive was 73.4 watt-hours per ton-mile. During 60 days, the average output of the frequency-changer substation was 70.25 watt-hours per ton-mile, although during another period of 30 days, when operating conditions were better, the average station output was 66.6 watt-hours per ton-mile. During 60 days of operation of the motor cars, the actual energy consumption at the car was found to be 55.9 watt-hours per ton-mile.

The electrical equipment of the Visalia 15-cycle, single-phase electric railway, including locomotive, cars and substation apparatus, was furnished by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

PIPE MOUNTING DISCONNECTING SWITCH.

In constructing high-tension distributing systems it is frequently desirable, or necessary, to employ disconnecting switches located in the high-tension conductors. The general practice is to mount the switches on insulators in turn mounted on marble bases provided with the necessary holes to permit fastening of the entire structure to a wall or panel board. In many cases, however, a much simpler and neater construction can be secured if pipe-work supports are used wherever possible and to meet these conditions the disconnecting switch illustrated herewith is being marketed by the Central Electric Company, Chicago, Ill. To insure a sufficiently high insulation factor, the switch contacts are secured to high-grade, petticoated insulators cemented to iron pins. The various contact areas are in accordance with recognized engineering practice and the several parts so proportioned as to give maximum mechanical strength. In common with standard practice, the switches are operated by means of a treated wooden rod having at its upper end a projection designed to fit a hole in the switch lever. A complete line for all ampere capacities in voltages from 1200 to 110,000 have been developed for pipe-frame mounting.



Disconnecting Switch.

PHILADELPHIA ELECTRICAL EXHIBITION.

The general interest taken in the Philadelphia Electrical Show by prominent citizens, who regard it in the light of a civic enterprise, to be encouraged as such, augurs well for the success of the show with respect to attendance; and the amount of space already taken six weeks ahead of opening indicates that the show itself will be exceptionally varied and interesting. Following is a list of the firms who have already signified their intention of exhibiting:

Commercial Truck Company, Century Electric Company, Judson C. Burns, Condit Electric & Manufacturing Company, Keystone Telephone Company, Westinghouse Electric & Manufacturing Company, Duntley Manufacturing Company, Robbins & Myers, *Electrical World*, *Electrical Review*, and *Western Electrician*, Werner Kaufman, Woodland Printing Company, Fort Wayne Electric Works, Keller-McManus Company, Shelton Electric Company, General Electric Company, The Philadelphia Electric Company, Jas. E. Caldwell & Company, Engineering Equipment Company, Electric Storage Battery Company, Simplex Electric Heating Company, Studebaker Electric, Edward Miller & Company, Hurley Machine Company, Roller-Smith Company, Williamson Motor Company, Philadelphia Electrical Contractors' Association, Nernst Lamp Company, Philadelphia Specialty Company, Vacuum Engineering Company and Johns-Manville Company.

CARBON REGULATOR FOR STORAGE BATTERY.

One of the most effective devices for use with storage batteries is the carbon pile regulator which is inserted in the field circuit of a reversible variable-voltage generator used for charging and discharging the battery according to the load on the system to which it is connected. When the regulator is used with the variable voltage generator the equipment is referred to as an "Entz" booster. The rapidity of action of the "Entz" booster has brought it to the front in England, as appears from the fact that the Chloride Electrical Storage Company, Ltd., of Pendlebury, near Manchester, has installed a considerable number of plants for handling fluctuating loads in both electric railway and isolated plants. The results are said to show considerable economies in coal consumption and in the amount of running plant necessary to handle the load. At the power plant of the Greenock Corporation the booster plant effected a saving of 20 per cent in the amount of coal consumed, equal to 2000 tons a year. This amount, after deducting interest, sinking fund and upkeep, is sufficient to pay for the cost of the plant in four years. At the Maidstone Corporation power house, where the booster plant is handling a railway load, the percentage of coal saved was even higher, and, as in other stations where this booster has been installed, one steam unit now deals with a load which formerly required two units. A similar saving in running plant has been effected at the Halifax Corporation plant, where a 750-kw unit and one boiler have been shut down, while the load on the generating plan can be kept constant within such close limits that no alteration to the boiler dampers is required from one week end to another. Boosters of this type have also been supplied to the following municipal electrical plants, among others: Llandudno, Falkirk and Blackburn.

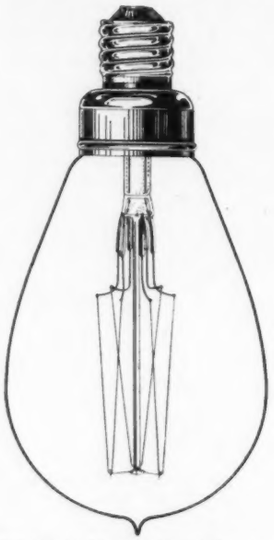
At the Motherwell Steel Works of David Colville & Sons, where there are about 4000 hp of motors, a booster battery plant has been installed capable of giving 1190 amp for one hour. This equipment has brought about a considerable economy in steam consumption and a reduction at top load of 50 per cent in the amount of running plant required. One set is now free to act as a standby, while the battery acts as a further standby, besides being available as a source of supply for week-end repairs and lighting. The Hanshin Electric Railway, Japan, has installed two plants capable of dealing with 2000 amp peaks, while the Nankai Electric Railway, Japan, has also put down a plant. The Cape Town Corporation has recently set to work a battery and "Entz" booster to handle all the crane load at the docks, which are supplied with energy from the lighting busbars. All of the peaks in this case are taken on the battery, and no fluctuation is apparent in the lighting pressure, because the booster maintains the feeder load at a definite fixed value. The Shanghai Municipal Council is now installing a booster for its street railway tramways, and the River Plata Electricity Company is putting one in for dealing with both its tramway and lighting loads at La Plata, South America.

INCANDESCENT LAMPS IN PLACE OF ARCS.

The new 250-watt Mazda street series lamp has just been standardized by the General Electric Company, which states that central stations which have employed this size of lamp with the old-style tungsten filament during the year, report a remarkable life, the results averaging well above 1300 hours, covering burnouts and breakage. Also, that a prominent illuminating engineer has made tests on this lamp which show that, with the new General Electric wave reflector specially designed for it, the lamp gives about 250 candles in a direction for street lighting. Two hundred and fifty candles, 8 deg. to 25 deg. below horizontal, is considerably in excess of the light given by the 6.6-amp series, alternating-current, enclosed arc lamp with clear inner and outer globes. It is claimed that, lamp for lamp, the new 250-watt Mazda may be substituted for the direct-current arc of 300-330 watts and 1200 nominal candlepower and for the alternating-current inclosed arc of 400 watts.

In substituting lamp for lamp the power required is reduced from 330 watts to 250 watts in the case of the direct-current arc and from 400 watts to 250 watts in case of the alternating-current arc. In the latter case there is a 37 per cent increase in the capacity of the power equipment, including series transformers, generators and engines.

The cost of operating this lamp for 4000 hours' service per year, all night, every night, is stated to be $23, apportioned as



250-Watt Mazda Street Lamp.

follows: Fifteen dollars for energy at 1½ cents per kw-hour; $7.50 for lamp renewals and $1 for trimming and labor costs. This is considerably less than the cost of operating any series arc lamp, the latter being over $30 in case of the 6.6-amp, alternating arc (450 watts at lamp terminals); this figure includes energy at 1½ cents per kw-hour, trimming, electrodes, outer and inner globes, repairs and labor.

The 250-watt Mazda series lamp operates satisfactorily on all series circuits. The lamp has a unity power-factor and shows practically no depreciation in candle-power throughout its life. The 250-watt lamp is made for current ranging from 4 amp to 8 amp and voltages from 62.5 to 31.2. The bulb has a diameter of 5 in.

ASBESTOS SHADES AND REFLECTORS.

The Asbestos-Gleam Manufacturing Company, of Philadelphia, Pa., has brought out a line of non-combustible shades and reflectors, which besides being as light as cardboard possess other merits. In making the reflector, asbestos fiber is ground into fine pulp and rolled into sheets under heavy pressure. The inner surface of these sheets is coated with a heavy deposit of aluminum which is afterward hardened and burnished so as to give a good reflecting surface. The outer surface is coated

Figs. 1, 2 and 3—Asbestos Shades and Reflectors.

with a waterproof, enamel-like green. The shades are brass bound and finished and are made in full deep cone, shallow cone and flat cone shapes. They are not liable to breakage if dropped, can be hung at any angle, are said to retain their brilliancy, and the aluminum, it is claimed, will not flake off like the enamel or paint on tin shades. A simple one-piece shade holder is made a part of all cluster shades to slip on ⅝-in. standard brass pipes.

Electric Vehicles at the New York Automobile Show.

There are 10 manufacturers of electric vehicles represented at the annual show of the Association of Licensed Automobile Manufacturers being held in Madison Square Garden, New York, Jan. 8 to 15. Nine of these have a number of pleasure cars on exhibition and three show electric commercial vehicles. The exhibits are located in the usual spaces accorded them in past years; the pleasure cars in the restaurant and the commercial vehicles in the basement. There is no noticeable departure from the construction of last year, which is to be expected; for there is a limit to the number of improvements which may be added to a car already representing the acme of constructive skill and in the design of which the experience of years has been embodied. Such improvements as are in evidence have to do only with minor details, which do not add to the efficiency of the car as a whole and serve to simplify the control and operation. The features of the various cars on exhibition are pointed out in what follows:

The Anderson Carriage Company, of Detroit, Mich., builder of the "Detroit" electrics, has a victoria, brougham, coupé and roadster on view. This company recently purchased the Elwell-Parker Electric Company, of Cleveland, builder of the well-known type of automobile motor bearing that name, and now utilizes the entire plant of the latter company for building motors, controllers and parts of chassis for its electric cars. The power from the motor in the Detroit car is transmitted to a countershaft through a chain running in oil. The countershaft, on which is fitted the differential gearing, is fitted with ball bearings. Double-chain drive is employed between the countershaft and the wheels and the battery is divided and placed under hoods in the front and rear of the cars. Motor brake and internal expanding hub and countershaft brakes are attached to all cars.

The Babcock Electric Carriage Company, of Buffalo, N. Y., exhibits a roadster, victoria-phaeton, two coupés and a town car. The batteries are built by the company, as is also the controller, and a double-chain drive is used on all but the town car, which has a worm drive. Friction is reduced to a minimum by ball and roller bearings, and lightness and graceful outlines are features of the vehicles turned out by this company. The weight of the battery is evenly divided over the front and rear wheels. An armored type of chassis is employed, with a wheel base of 78 in. The motor is suspended under the center of the chassis, and a wheel-steering post, with break joint, so as to permit ingress to and egress from either side, is a feature of all the vehicles. The coupé and other cars are equipped with powerful expanding brakes in the hubs of the rear wheels, and a Raymond brake on the countershaft. The controller permits five forward and two reverse speeds, ranging from 6 to 25 miles per hour. Other features of the Babcock vehicles are the safety foot control, which is said to render accidents practically impossible, and a foot accelerator for controlling each of the speeds.

S. R. Bailey & Company, Amesbury, Mass., show two victoria-phaetons. The vehicles are equipped with Edison batteries hung by three-point suspension under the center of the floor, and a General Electric drum-type controller and series-wound, 60-volt or 48-volt motor. The controller is located under the front hood and the motor under the rear hood, which, owing to the absence of batteries in these locations, are not prominent. A silent chain connects the motor to the countershaft, and a double roller chain is used on the rear wheels. A steering column is used, and the speed control lever is mounted on top of the wheel in much the same manner that the spark lever is mounted in most gasoline cars. Ball bearings are fitted to the countershaft and motor, and a pivoted bearing is used in the wheels. A manganese bronze bushing is fitted in the hub of the wheel, and between the axle and the hub there is a space of about 0.002 in., which is filled with oil. The hub is capped in and collared, so that the wheel revolves on a film of oil and the end-thrust is taken up on a pivot. The brake is interlocked with the controller, so that if the circuit should be interrupted the brake is applied. It is also impossible to apply electricity to the motor as long as the brake is on, because the key or plug cannot be inserted with the controller in any running position. The body of the vehicle is made of laminated wood, and is consequently very light in weight. The vehicles are equipped with large wheels, and are said to have an enviable mileage record.

The Baker Motor Vehicle Company, Cleveland, Ohio, has five pleasure vehicles and one chassis on exhibition in the restaurant and two chasses for commercial vehicles are shown in the basement. All the vehicles are fitted with bevel-gear transmission, having a specially designed gear tooth which is said to give almost perfect rolling contact between the bevel gears. There is a straight-line drive and improved type of universal frictionless joint. The maker claims that by the employment of the shaft drive not only are all chain troubles eliminated, but constantly increasing efficiency is obtainable. The bevel gear drive is entirely encased and protected, so that it cannot become clogged by dirt or affected by the weather. Owing to the absence of lost motion, wear and tear on the running gear are reduced, and the lubrication being constant and automatic the drive requires a minimum of attention. A feature of the drive to which the manufacturer directs attention is the almost entire absence of noise when the car is in operation. The new models have also a longer wheel base than is ordinarily found in electric vehicles. They are equipped with continuous torque controller, with mechanical lock and safety device and special four-pole, series-wound motor with large commutator. The motor is attached to the frame by three-point suspension, and the controller gives six speeds forward and three speeds reverse. A special mechanical lock is fitted to the controller, taking the place of the plugs commonly used, and necessitating the use of a key. Steering rods on all of the cars are equipped with ball and socket shock absorbers, and ball and socket joints equipped with springs to prevent rattling are also used on the connecting rod between the steering knuckles. Internal expanding brakes are fitted to the rear wheels, and an emergency bank brake on the motor. Both brakes are mechanical and operate by foot levers. The chasses of the commercial vehicles are equipped with one motor, have the batteries connected permanently in series, have a continuous torque, drum-type controller, side chain drive, ball bearings and steel frame. A silent chain connects the motor to the countershaft, and a double chain is used from the countershaft to the rear wheels. In the larger wagons Timken roller bearings are employed in the front and rear wheels, and annular ball bearings in the motor and countershaft. The 4000-lb. wagon is driven by a 4-hp motor.

The Columbia Motor Car Company, Hartford, Conn., exhibits three pleasure vehicles which embody changes in mechanism over previous models, although preserving the original outward design. These are an emergency brake working on a drum on the motor countershaft, in addition to the regular double-acting brake on the rear wheel hub drums, and the use of ball bearings in all four wheels. The body rests on four long semi-elliptical springs, and the motor and all mechanical parts are attached directly to the body. A reduction gear and enclosed chain connect the motor to the differential gear on the driving axle, which runs in a tubular casing, with all of the working parts housed to exclude dirt. The motor, which is of General Electric design, transmits its drive through a steel helical pinion and bronze helical gear to the countershaft, and thence by sprocket and chain to the rear axle. The controller permits six speeds forward and three reverse. All running gear is of the reachless type, with a single motor drive. The battery is made up in two trays, divided so that the weight is distributed equally over the front and rear axles.

The General Vehicle Company of New York, exhibits in the basement a 10,000-lb. truck, a one-ton, light delivery wagon and

the chassis of a 2-ton truck. The vehicles are equipped with the G. V. battery, giving them a radius of 40 miles on a single charge and a speed of from 10 to 11 miles per hour. The chassis illustrates the general design of the power plant construction. The battery which furnishes the electricity for an 85-volt motor is suspended below the main frame in a cradle, and is placed in sectional crates. The controller is of the continuous-torque type, speed changes being effected without interrupting the supply of energy to the motor. The latter has its armature revolving in ball bearings, and is suspended on a cross-bar pivoted to the side frames in front of the rear axle. Double chain drive is used from the countershaft, consisting of two short shafts connected by a differential of the spur-gear type, each shaft being connected to a rear wheel through sprockets and roller chain. The battery employed is manufactured to meet the specifications of the company, and the plates, jars, straps, separators and connections are designed to withstand hard usage. Under the battery plates a space 2¾ in. deep is provided to accommodate the sediment accruing during one-half of the normal life of the plates. The battery is said to possess the greatest capacity possibly obtainable per pound of lead consistent with regard for cost of operation, and the cost per mile of operation is said to be consequently reduced. The plates are made in such proportion to each other that the positives and negatives will have equal life, and may be renewed at the same time without sacrificing either.

The Rauch & Lang Carriage Company, of Cleveland, Ohio, exhibits a coupé, victoria, landaulet and roadster. The chassis consists of a cold pressed steel frame, to which all the machinery, springs, axles and other parts are attached. This method of construction permits of change of bodies to suit the various seasons of the year. The axles are made of nickel steel, and Timken roller bearings are used in the wheels, all joints in the steering gear being of the ball and socket type, spring cushioned and adjusted for wear, so as to avoid rattle. Two side chains drive direct to the wheels mounted on a stationary rear axle. All parts of the power plant in the vehicle are placed above the springs, so as to be protected against road shocks. The countershaft, motor, controller and controlling devices are mounted on a single manganese casting or subframe, so designed as to hold each in alignment with the others and permit of adjustments for all contingencies. This subframe is suspended as a unit from the steel frame at three points. Annular ball bearings are used throughout, and these, combined with the silent chain used to transmit power from the motor to the countershaft, produce a unit power plant of high efficiency. The motor employed is of the multipolar type of the company's own design, and is said to possess a very high efficiency over a wide speed range. The controller is of the continuous-torque type, and gives six speeds forward and three reverse. Two expanding hub brakes are located in the rear wheels, and are operated by a foot piece placed in the floor. In addition to these there is an electric brake and a mechanical motor brake that can be applied by an extreme backward movement of the controller handle. The steering and control levers used in the Rauch & Lang vehicles possess many features of merit.

Studebaker Automobile Company, of South Bend, Ind., is represented both among the pleasure cars and commercial vehicles. A coupé, victoria, stanhope and landaulet are on exhibition in the restaurant. These cars are equipped with Westinghouse motors suspended from the chassis frame and controlled by Studebaker type continuous torque controllers, fitted with an interlocking device which prevents throwing in the switch that completes the circuit between the motor and the batteries unless the controller handle is at the off position. The controller gives five speeds forward and three backward. Two brakes are provided, one a constricting brake on the armature shaft drum operated by the controller, and the other of the internal expanding type operated through a pedal on both rear wheels. One of the features of the vehicles is the floating type of rear axle, which makes it possible to employ practically a solid rear axle to carry its share of the weight of the car, relieving the joining points of the two live axles at the differential from bearing any part of this load. Its connection with the wheels is by means of a dog clutch, fitted with a square socket, into which the squared end of the driving or floating axle is entered. The driving axle thus floats free in the housing, and only comes in contact with the socket in the differential and the dog clutch at the wheel end. The commercial vehicles exhibited by this company comprise one-half ton and one-ton wagons and a three-ton truck, in addition to a chassis.

The Waverley Company, Indianapolis, Ind., has five cars on exhibition—a roadster, victoria, brougham, coupé and a stanhope. A feature of all of these cars is the driving system introduced early last year. The motor and flexible gearcase are combined in a single unit, and assembled on cross pieces attached to the body frame. Rubber cushions separate these cross pieces from the motor support frame in such a way as to overcome the effects of vibration. Power from the motor is transmitted to the floating rear axle by a flexible gear, a shaft parallel with the axle, and a small herring-bone gear on the rear axle. The flexible gear is enclosed in a dust-proof case, runs in a continuous bath of oil and operates a shaft floating between the springs parallel with the axle and fitted with universal joints. The construction of the driving axle and the differential is such that there is no load carried on the former or end thrust on the latter, power being transmitted to the hubs by means of a clutch at the outer end. The axle frame is of the tubular type, all brackets, spring seats, etc., being riveted on. The wheels are fitted with Timken roller bearings and Hess-Bright ball bearings are used on the gear and pinion shafts, all of which are fully encased and protected from dirt and grit. The internal expanding brake consists of two separate shoes pivoted and floating on a single pin. While the motor shaft is equipped with a contracting band brake. The controller consists of a core on which are assembled blades of various widths engaging in fingers attached to the frame of the controller. This system of knife-blade contacts possesses an advantage in that in passing from one speed to another the contact of one speed is not broken until that of the other has been made. There are four forward and four reverse speeds available, and the method of connection is such that the circuit is never broken after the power is once applied. A new feature of the controller is an interlocking device, which makes it impossible to change the speed with the motor on, and which also prevents the machine from starting in either direction until the lever handle is brought back to low speed. The motor is of special design, aluminum being employed in its makeup wherever possible.

The Woods Motor Vehicle Company, of Chicago, Ill., displays four pleasure cars, three coupés and a roadster. The Woods cars are equipped with 40 cells of battery and have solid rubber tires. Like other cars, each vehicle is fitted with roller bearings on wheels and motor. The transmission is one of the mechanical features of the car. A pinion on the motor shaft drives a large gear wheel mounted on the differential housing situated on the under side of the motor frame. Power is transmitted from each end of a bevel gear differential through a universal joint shaft to the driving sprockets, and thence by chains to the rear axle. By the employment of double helical or herring-bone teeth on the pinion and differential gear wheel, smooth running is obtained. The sprocket ends of the shaft are mounted on outboard bearings, the housings of which are supported on short transverse studs, so that they can swing in the longitudinal direction of the car. Each outboard housing is connected to the rear axle by a distance rod made in two sections, joined by a turnbuckle, so that the chain tension may be adjusted without destroying the axle adjustment. A four-pole, series-wound motor is employed in connection with a controller of the drum type, giving four speeds by changing the battery and motor connections. Two brakes, foot-operated, and one operated by a reverse motion of the controller handle are fitted on each car.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

There has been something of a lull in business throughout the country since the beginning of the year. This perceptible check is not regarded, however, as being at all serious, and has not interfered with the general feeling of optimism which prevails with regard to 1910. The severe cold weather and heavy storms throughout the West are responsible, in a great measure, for the temporary pause in business activity. The wholesalers and jobbers have generally had a quiet week, owing not only to weather conditions, but to the fact that the salesmen who started out the first of the year have not yet reached their territories. For the same reason re-orders have been somewhat slower. While the activity in industrial lines continues to be tremendous, the weather has had the effect of stopping many outdoor projects, such as railroad construction and general building. It is said also that many of the railroads are holding back their orders for equipment and rails, the specifications for which are prepared, pending the action of Congress upon the recommendations made in the recent message of President Taft. Beyond the switchmen's strike in the Northwest, which continues to interfere with traffic, there have no serious labor troubles developed since the beginning of the year. The excessively high prices of all commodities is having its effect, however, and demands for increased wages are certain to be made in many industries early in the spring. Collections are rather slower, and merchants are beginning to complain on this account. Business failures for the week which ended Jan. 6 were 271 as against 257 the previous year; 239 in the same week of 1909; 435 in 1908; 283 in 1907, and 286 in 1906.

THE COPPER MARKET.

The domestic copper market during the past week has been dull with few sales, although prices have been held firm by producers at about 13⅞ cents for electrolytic, 30 days delivery, and 14 cents for lake. The London market was more active. The feature of the week was the December report of the Copper Producers' Association. While this showed a considerable reduction in the surplus stocks it was disappointing in that the domestic deliveries were smaller than had been anticipated and the exports were also below original calculations. The most encouraging feature for the month was the reduction in the production. While this was not enough to cut much figure in the general result, it indicated that producers had at last taken steps to bring supply somewhere within region of consumption. The figures for the month were: Production, 117,828,655 lb., a reduction of 3,789,714 lb.; domestic deliveries, 69,519,501 lb.; exports, 59,526,570 lb.; surplus stocks in domestic producers' hands Jan. 1, 141,766,111 lb., a decrease from Dec. 1 of 11,237,416 lb. This total stock of copper in producers' hands compares with 122,357,266 lb. on Jan. 1, 1909. It is well understood, however, that these figures do not represent the entire growth of surplus during the year. Consumers at home have greatly increased their holdings and the visible supply abroad has increased 170,000,000 lb. It is estimated that the total increase of the copper surplus is about 265,000,000 lb. Exports so far for January have been 3,187 tons. The daily call on the Metal Exchange Jan. 10 quoted standard copper as follows:

	Bid.	Asked.	Settling price.
Spot	13.37½	13.62½	.....
January	13.37½	13.62½	13.50
February	13.37½	13.62½	13.50
March	13.37½	13.62½	13.50
April	13.37½	13.62½	13.50

The London prices were as follows:

	Noon.	Close.
Standard copper, spot	£61 12 6	£61 12 6
Standard copper, futures	£62 10 0	£62 10 0
Market	Firm	Steady
Sales of spot		500 tons
Sales of futures		300 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	13.50c.	13.37½c.
London, spot	£62 0 0	£61 1 3
London, futures	£62 18 9	£61 1 3
London, best selected	£65 10 0	£65 5 0

Rand-Mitchell Manufacturing Company.—The Rand-Mitchell Manufacturing Company, 88 Maiden Lane, New York, has been organized to take over the business of W. E. G. Mitchell and to handle, as he has in the past, all sorts of material for insulation, including saturating and finishing waxes and waterproof compounds for insulated wire, hydrocarbon compounds, sealing cements, dry battery wax, asphalt, pot-head compounds, rubber substitutes, insulating and waterproofing paints, etc. The president of the new company is Lyman F. Rand, who has been engaged in this line of work for over 25 years, manufacturing these products for A. T. Howard & Company and for W. E. G. Mitchell, their successor, is a chemist and a graduate of Brown University. W. E. G. Mitchell is vice-president and treasurer. Mr. Mitchell succeeded A. T. Howard & Company about 14 years ago in the insulating business, and is a graduate of the electrical and chemical courses at Pratt Institute. He is also interested in the Steers Supply Company and the Universal Compound Company. Charles L. Rand, secretary, is a graduate in chemistry at Cornell University, having acted also as assistant instructor in chemistry at Cornell. He is largely engaged in research work on waxes and hydrocarbon compounds. The new company has extended its field to include fiber, mica, varnish and cloth.

Baltimore-Philadelphia Electric Line.—An electric line is soon to be established between Baltimore and Havre de Grace, Md., which will ultimately be extended on to Philadelphia. Within the past few weeks the company has been formed to construct the contemplated line, which is composed of Baltimore, Belair and Havre de Grace capitalists. J. Alexis Shriver, of Belair, Md., who is associated with the Baltimore & Belaire electric line, a company which is already in existence, and one of the incorporators of the new company, explained that the right-of-way for the line had already been procured and that most of the survey work had been completed. As it is now proposed the road will touch Belair, and will be about 38 miles long. It is the purpose of the promotors to eventually extend the road to Philadelphia. It is more than likely that the power to operate the cars between the two cities will be furnished by the McCall Ferry Power Company. The cost of constructing the new line will be about $1,500,000.

Growth of Telephone Business.—The American Telephone & Telegraph Company has given out the statement that the Associated Bell Companies added to their service during 1909 a daily average of 2,000 telephones, or a total addition for the year of over 600,000. On Dec. 31 there were about 5,000,000 telephones in the system, of which 1,500,000 are owned by companies not controlled by the American Telephone & Telegraph Company, but operated under contract agreements with the Bell interests. The big company added 400,000 miles of wire during the year, and now owns a total of 10,250,000 miles. The total net properties were valued on May 1, 1909, at $712,500,000, with outstanding capital obligations against them of $592,500,000.

Railway Motor Equipment.—The Third Avenue Railroad Company, of New York, has just placed an order for 100 double-motor car equipments. The General Electric Company and the Westinghouse Electric & Manufacturing Company each secured contracts for 50 of these equipments. The equipments include two 70-hp motors each, with wiring and control. The Westinghouse Electric & Manufacturing Company contracted last week with the Nassau Construction Company, of Roslyn, N. Y., for four 4-motor car equipments for the New York & North Shore Traction Company. These motors are 40 hp each, and the equipments include wiring and control.

Big Fertilizer Plant Projected.—It is stated that a $10,000,000 fertilizer plant is to be built near Ridgeville, S. C., on the Ediste River, to be operated by hydroelectric power. D. G. Zeigler, of Florida, is said to be interested in the proposition, and it is reported that a Chicago syndicate has made an offer toward the construction of such a plant.

National Conduit & Cable Company.—Orders have been placed by the National Conduit & Cable Company with the Allis-Chalmers Company for 13 induction motors, varying in size from 15 to 75 hp. A steam turbine unit made by the same manufacturing company is now being installed.

St. Lawrence Power Company.—At a meeting of the directors of the St. Lawrence Power Company in Montreal on Jan. 4, F. H. McGuigan, of Toronto, was elected president, and George G. Foster, K. C., of Montreal, vice-president. This is the company which has made application to the Dominion Government for authority to develop power at the Long Sault Rapids near Cornwall, mention of which was made in our issue of Nov. 4. The plans of the company have been submitted to M. J. Butler, Deputy Minister of Railways and Canals, and Messrs. Lafleur and Anderson, engineers of the Public Works and Marine departments, respectively. Three different plans have been prepared showing the proposed conservation of the water-power now going to waste. The development of power is approximately 150,000 hp at the foot of the Long Sault Rapids on the St. Lawrence River.

Thompson-Levering Company.—The Thompson-Levering Company, with offices at 244 Arch Street, Philadelphia, Pa., entered the electrical measuring instrument field the first of the year. The new company proposes to manufacture testing sets, and a full line of electrical measuring instruments, and also to repair instruments of like character. Mr. Thompson has been for the past few years manager of the electrical department of Queen & Co., Philadelphia. Mr. Levering has been assistant superintendent of the Electrical Laboratory, and has had 17 years' experience in high-grade resistance, condenser, and galvanometer work, and is fully experienced in all lines of electrical testing instruments. Mr. Corcoran, of the staff, has been in charge of the galvanometer department for a number of years past.

Cuyahoga Light Company.—A letter has been sent to the city authorities of Cleveland, by Vice-President J. George Kalber, of the Cuyahoga Light Company, declining to accept the franchise granted to the company by the City Council on Dec. 13. The reason for this refusal is objection to the clause giving the city the right to purchase the plant after three years, at a price to be fixed by a board of arbitration. The franchise also limited the charge for energy to 5½ cents per kw-hour. It is also announced that John C. Keys has resigned the presidency of the company and would move to another city as soon as a successor is chosen. It is also denied that there is any plan for consolidation with the Cleveland Electric Illuminating Company.

Proposed Electric Light Plant in Asia.—An American consul in Asia has sent a comprehensive report on the possibility of establishing an electric light and power plant in a large city in Asia. The consul gives the proposition thorough consideration from every standpoint, and states in conclusion that an excellent opportunity is now presented for the investment of American capital and the introduction of electrical equipment. Interested parties may have a copy of this report upon application to the Bureau of Manufactures, Department of Commerce, Washington (No. 4356).

Sheboygan (Wis.) Power Plant.—Arrangements are being made by J. M. Kohler & Sons Company for the construction of a large power plant in connection with the company's manufacturing plant at Riverside, Wis. The equipment of the power house will include a 1,000-hp cross-compound condensing engine, direct-connected to a 750-kw Crocker-Wheeler generator. There will be auxiliary equipment, which will include a 375-hp Corliss engine, direct-connected to a 250-kw generator, and a 150-hp Corliss engine belted to a 150-kw generator.

To Electrify Lackawanna Railroad.—T. E. Clark, general superintendent of the Delaware & Lackawanna Railroad, has announced that the company has plans under consideration for the electrification of portions of the line, which will probably be carried out during the present year. The plans call for the placing of electric locomotives on the various suburban lines of the company, while heavy locomotives of the same type will be installed for handling the freight over the steep grades in the vicinity of Scranton. Definite information as to the portions of track to be electrified was not given out.

Home Power & Irrigation Company, Morrison, Col.—Articles of incorporation have been filed for the Home Power & Irrigation Company at Morrison, Col., with a capital stock of $1,500,000. The company proposed to construct a power plant on the Bear River, near Morrison. The energy will be sold in the adjacent territory, and, it is expected, ultimately in Denver. A reservoir will be constructed by building a 96-ft. dam, with a capacity of 40,000 acre-feet, and the main canal will be 12 miles long. In addition there will be 60 miles of lateral lines. The system is expected to irrigate 25,000 acres of arid land.

Foreign Market for Electrical Supplies.—An American consul states in a recent report that an electrical company in the city in which he is located is desirous of getting in touch with manufacturers in this country exporting electrical supplies, such as insulated wires, electric meters, electric burners, etc. If prices and goods prove to be satisfactory, the consul thinks this firm will be a good customer. The Bureau of Manufactures, Department of Commerce, Washington, has the name on file (No. 4353).

Progress on Mexican Northern Development.—The Mexican Northern Power Company has been notified by its engineer, W. J. Davis, Jr., that the surveys for the tramway from Santa Rosalie, on the Mexican Central Railway, to the La Boquilla dam site, 20 miles, have been completed. Construction work commenced by the contractors, S. Pearson, Son & Company. It is expected the road will be completed before the end of April for the handling of the necessary plant and equipment with which to construct the power-development works.

Colorado Electric Power Irrigation Project.—Plans are being developed by J. R. Carper, of Denver, Col., for the construction of a large hydroelectric plant near Boulder, Col., to furnish electrical energy to supply water for the irrigation of several thousand acres of land in the eastern part of Weld County, Colorado. The project will involve an expenditure of several million dollars. It is said that the proposed plant when completed will develop 10,000 hp.

Independent Telephones in Chicago.—Announcement is made that the Illinois Tunnel Company has arranged with the independent telephone interests for entrance into Chicago. It is said that $5,000,000 will be expended at the outset in bringing in these lines. The receivers of the tunnel company have entered into a tentative contract with the independent interests that calls for the immediate installation of 20,000 telephones. This is the smallest equipment that can comply with the telephone franchise held by the tunnel company.

Electrical Supplies for Mexico.—An American consul in Mexico reports that a company in his district desires to get in touch with American manufacturers of electrical supplies, such as insulated wires, electric meters, electric burners, etc. The consul states that if prices and goods please the concern it will prove a steady and remunerative customer. Further details may be obtained from the Bureau of Manufactures, Washington, the file number being 4378.

Washington-Norfolk Electric Road.—Announcement has been made in Norfolk, Va., that certain interests backed by the Goulds will undertake the construction of an electric railway from Washington, D. C., to Norfolk, by way of Richmond, such a road to all intents paralleling the Richmond, Fredericksburg & Potomac Railroad. It is understood that the line will be electrically propelled. The route is approximately 200 miles in length.

Electrical Construction.—Among the items printed under Construction Notes in our present issue are announcements of proposed new plants or considerable extensions of present plants at Raymond, N. H.; Los Angeles, Cal.; Heyworth, Ill.; Searcy, Ark.; Walter, Okla.; New Richmond, Wis.; Bellingham, Wash.; Camden, Tenn.; Houston, Tex.; Sheboygan, Wis.; Sylva, N. C.; Durant, Okla.; Fergus Falls, Minn.; Marysvale, Utah; Neillsville, Wis., and Portales, N. M.

Cutler-Hammer New York City Factory.—The New York City factory of the Cutler-Hammer Manufacturing Company, located in the Borough of Bronx, at 144th Street and Simpson Avenue, and recently finished, has a floor space of 100,000 square ft. The building is five stories high, of brick and steel construction, and is stated to be the largest in the world devoted exclusively to the manufacture of electric controlling devices.

Special Service for Central Station Companies.—The Black & Loder Company, 30 Church Street, New York, have organized a system of service which it offers to central station companies to assist in the profitable conduct of their business. This includes the analysis of existing conditions, and recommendations as to administration policies, working organization, business methods, etc.

British Columbia Electric Railway Company.—In connection with the extensions now under way and proposed to be undertaken by the British Columbia Electric Railway Company, mention of which was made in our issue of Dec. 30, it is reported that the C. C. Moore Company, of San Francisco, has been awarded the contract for the construction of the building of the auxiliary steam plant at Vancouver. The contract price for the building is about $250,000, which includes the erection of a reinforced-concrete chimney 250 ft. high. The Allis-Chalmers Company, of Milwaukee, has been given an order for the installation of two 3000-hp turbo-generators.

Belknap Power Company, Utah.—Plans are being considered by the Belknap Power Company, of Marysvale, Utah, for the construction of a hydroelectric power plant in the Sevier River, to supply energy for lamps and motors for the towns in the Gold Mountain and Marysvale districts. The cost of this plant is estimated at $3,000,000, and it is said that it will develop from 6000 to 7000 hp.

New Mica Firm.—Meirowsky Bros., formerly with one of the leading European mica firms, has established a business at 131 Liberty Street, New York, as importers and manufacturers of mica, giving particular attention to direct shipments from India. The members of the firm have had experience in the management of mica mines in British India and in the designing of electrical plants.

Winnipeg (Man.) Tenders.—Tenders will be received up to Tuesday, Feb. 15, for the supply and erection of various portions of the equipment for the municipal transformer station at Winnipeg, and for turbine governors and gate valves for the generating station at Point du Bois. Specifications and plans may be seen at the office of Smith, Kerry & Chace, Confederation Building, Toronto.

Niagara Falls Hydraulic Power & Manufacturing Company.—An order has been placed with the Allis-Chalmers Company for two 6,500-kw, 1200-volt, 25-cycle, hydraulically-driven generators by the Niagara Falls Hydraulic Power & Manufacturing Company. These machines will be duplicates of the two already installed by the Allis-Chalmers Company in the same plant.

Montreal Gas & Electric Company.—The Montreal Gas & Electric Company has organized a business department for the purpose of making an aggressive campaign to increase its list of customers. Both the lighting and power business will be actively pushed, and especial effort will be made to develop the sign business. B. G. McNabb has been placed in charge of this department.

Derry (N. H.) Electric Light Company.—The Derry (N. H.) Electric Light Company is making arrangements to discard its direct-current machines, and to replace them with three-phase, 60-cycle alternating-current generators. Some of these generators have already been installed, and the company is now changing its wires for the new system.

Standard Underground Cable Company.—The stock of the Standard Underground Cable Company advanced last week on the Pittsburgh stock exchange from 220 to 300. The earnings of the company have been exceptionally large during the past year, and a big extra dividend is expected.

Edison Electric Illuminating Company, Boston.—The Edison Electric Illuminating Company of Boston on Jan 1 reduced the basic price of its energy for lamps from 12 cents to 11 cents per kw-hour.

The Northern Engineering Works, builders of "Northern" cranes, Detroit, Mich., have purchased additional land adjoining their present plant on which they will make extensions of their crane department.

Financial Intelligence.

THE WEEK IN WALL STREET.

The stock market during the past week has been distinctly disappointing. Not only has that "January advance," for which so many professional traders loaded up in December, failed to materialize, but prices have actually declined several points in spite of zealous efforts to keep them up. This has happened, too, in a market that has been exceptionally active. There has been a persistent disposition to sell by all speculators and small holders, and every disposition that the market showed to rally was checked by liberal offerings of those who wanted to get out. Developments which contributed to this condition were the uneasiness felt over the President's recommendations concerning railroad corporations and the persistent refusal of the rates for call money to recede. The former of these causes was more of a scare than reality. No one really expects any damaging legislation to result from Mr. Taft's message, but the more conservative traders feel that it is just as well to be out of the market as in it, until after Congress has shown its hand. The money market is something of a puzzle. With banking conditions abroad vastly improved and with good bank statements at home the money market is still held tight. Rates Jan 10 were: Call 4 @ 6 per cent, 90 days 4½ @ 4¾ per cent. The quotations in the table are of the close Jan. 10.

NEW YORK.

	Jan. 3.	Jan. 10.	Shares sold.		Jan. 3.	Jan. 10.	Shares sold.
All.-Ch.	15	14½	2,300	Int.-Met., pfd.	60⅜	60⅛	30,200
All.-Ch., pfd.	54½	53⅝*	1,200	Mackay Cos.	91	90½*	700
Amal. Cop.	90⅜	87¼	244,330	Mackay C., p.	77½	78¼	600
Am. D. T.	20½*	20½*	——	Man. Elev.	138	137*	1,259
Am. Loc.	61½	59	7,600	Met. St. Ry.	23*	23	——
Am. Loc., pfd.	115	114½*	740	N.Y.&N.J.Tel.	139¼	139¼*	——
Am. Tel. & C.	77½*	77½*	——	Steel, com.	89⅛	87⅜	1,156,700
Am. T. & T.	140⅝	139⅞	13,650	Steel, pfd.	124¾	124	11,860
B. R. T.	79¼	78⅝	14,300	W. U. T.	76⅜	76¼	1,900
Gen. Elec.	159⅜	158½	8,747	West'h., com.	81¼	81⅛	4,520
Int.-Met., com.	24	24½	41,750	West'h., pfd.	130*	128¼	100

PHILADELPHIA.

	Jan. 3.	Jan. 10.		Jan. 3.	Jan. 10.
Am. Rys.	48	49⅜	Phila. Elec.	14	14¼
Elec. Co. of A.	12¼*	12⅜	Phila. R. T.	28⅜	27½
Elec. St. B'ty.	61	62	Phila. Trac.	88¼	88½*
E. S. B'ty, pfd.	30*	30*	Union Trac.	52¼	52¼

CHICAGO.

	Jan. 3.	Jan. 10.		Jan. 3.	Jan. 10.
Chi. City Ry.	180*	180*	Chi. Tel. Co.	137	135
Chi. Rs., Ser. 1	109	107	Met. El., com.	17¾	17*
Chi. Rs., Ser. 2	35	32½	Met. El., pfd.	55½*	55
Com. Edison	120	121	Nat'l Carbon	108½	111
Chi. Subways	4¾*	4¾*	Nat'l Car., pfd.	122½*	122½*

BOSTON.

	Jan. 3.	Jan. 10.		Jan. 3.	Jan. 10.
Am. T. & T.	140¾*	140¼	Mex. Tel.	2¾	2¾*
Cum. Tel.	144	143½	Mex. Tel., pfd.	6*	6*
Edison E. Ill.	251¾	247	N. E. Tel.	137½	137
Gen. Elec.	159¼	159	W. T. & T.	16½	17
Mass. E. Ry.	18½	18	W. T. & T., pfd.	94	94
Mass. E. R., pfd.	80¾	80			

*Last price quoted.
Shares sold are for week of Jan. 3 to Jan. 8.

Big Merger Project for Montreal.—A $100,000,000 merger embracing the Montreal Street Railway Company and the Montreal Light, Heat & Power Company is a project now being formulated in Canada. For some time past, and particularly during the last few days, there has been unusual activity in Montreal Power & Street Railway securities causing a good many rumors to be set afloat regarding a possible merger of these two companies. It now appears, however, that a great tunnel or subway project is being considered, together with a coalition or consolidation of these two companies into a holding company with a capital of $100,000,000, of which $60,000,000 will be in stock and $40,000,000 in bonds. English engineers have been in Montreal and have approved of the project, and while London wished to do all the financing, half has been given to a group of Montreal capitalists identified with the power and street-railway properties. The tunnel scheme provides for a six-track subway from Maisonneuve in the east to Notre Dame de Grace in the extreme west, with branch lines taking in all the existing railway stations and a great central station downtown in the heart of the city. Then the south shore is reached by a double-track tunnel and most of the railways entering the city have agreed to participate in the enterprise. All the traffic handled through the city will be conveyed by electricity as the motive power.

United Railways of Baltimore.—There is and has been for some time past in the Baltimore market a quiet absorption of the Baltimore United Railway & Electric Company's income 4 per cent bonds and stock. Buying of the former issue is based upon the expectation that beginning with June 1, 1911, coupons will be paid in cash instead of in script, as at present, while buying of the stock has been stimulated by knowledge that the year just closed was the most satisfactory in the history of the company, both in earnings and the reduction of indebtedness. Fixed charges were increased during the year $78,000 by an issuance of $1,000,000 of Maryland Electric Railway 5 per cent bonds, principal and interest on which is guaranteed by the United Railways, and $560,000 of funding 5 per cent bonds, issued to fund coupons on $14,000,000 of 4 per cent income bonds. The property is in better physical condition than ever before.

Continental Telephone & Telegraph Company.—It is announced that the Continental Telephone & Telegraph Company has purchased securities of the Rochester Telephone Company to the extent of $330,000. This money is to be used to strengthen the financial condition of the Rochester company. In connection with this transaction the management of the Continental company gives out that it is planned to form a national independent long distance company, which will be in close affiliation with large Independent operating companies, enabling the service to reach all of the large cities between the Atlantic Coast and the Rocky Mountains. The purchase of the securities of the Rochester company also provides for the financing of the Syracuse and Utica Independent companies. The Continental company will soon have, it is said, an independent line through from Buffalo to Poughkeepsie, and lines covering New Jersey and Pennsylvania, and reaching to Washington.

Washington, Baltimore & Annapolis.—Stockholders of the Washington, Baltimore & Annapolis Electric Railway Company held their annual meeting at Naval Academy Junction last week, and, in addition to re-electing the old officers of the company, selected a new board of directors. The board named last week consists of Messrs. John G. Masterton, George A. Craig, Frank K. Ginn, and the following officers of the company: George T. Bishop, president; John Sherwin, vice-president; J. N. Shannahan, second vice-president and general manager, and Charles F. Gladfelter, secretary and treasurer. At the meeting last week there was no discussion of any probable plan looking to the reorganization of the company, which is in the hands of the receivers. The stockholders are gratified at the showing which the line is now making in the way of increased earnings.

Allerton, Greene & King.—The firm of Allerton, Greene & King has been formed in Chicago, with offices in the Rookery Building, for the purpose of conducting a general bond and investment business. The firm will give especial attention to municipal, railroad and public service bonds. It has already on sale a large list of the bonds of traction and lighting companies. William K. Hoagland, formerly with the Northern Trust Company, of Chicago, will be the office manager. Members of the firm are: Samuel W. Allerton, capitalist; Frank R. Greene, formerly secretary of the Chicago City Railway Company; Calvin P. King, formerly cashier of the Havana National Bank, Havana, Ill.; Mason B. Starring, president of the Northwestern Elevated Railroad Company, and Newton C. King, president of the Havana National Bank.

Philadelphia Company, of Pittsburgh.—The recent issue of $2,760,000 of common stock of the Philadelphia Company of Pittsburgh, which was offered to the stockholders at par, has been underwritten by a London syndicate headed by the Swiss Bankverin. This has been done in order to introduce the securities of this company in the London market. The United Railways Investment Company is the holder of $24,200,000 of the common stock of the Philadelphia Company, which is approximately 75 per cent of the total outstanding. The Investment company agreed to waive its right to subscribe to the new stock, in order that the shares might be placed on the London market.

United States Telephone Company.—According to Clarence Brown, general counsel for the Independent telephone interests in Ohio and Indiana, which were recently taken over by J. P. Morgan & Company, the election of Frank A. Davis, of Columbus, Ohio, to succeed James S. Brailey, Jr., of Toledo, as president of the United States Telephone Company, is the only change in officers which will be made at the meeting in Cleveland next week. Mr. Davis will continue to be president of the Citizens' Telephone Company, of Columbus, and the headquarters of the United States company will be removed from Cleveland to that city.

Western Electric Company Bonds.—Announcement is made that the Western Electric Company will issue and sell at once $5,000,000 of the $15,000,000 of 5 per cent bonds which were authorized by the stockholders at a special meeting held in November, 1907. The proceeds of the sale of these bonds will be used to take the place of commercial paper, and in liquidating current indebtedness. The remaining $10,000,000 can be sold from time to time at the discretion of the board of directors. The Western Electric has an authorized capitalization of $25,000,000, of which $15,000,000 is outstanding. Of this amount the American Telephone & Telegraph Company owns more than $12,000,000.

Chicago Consolidated Traction Company.—Definite steps have been taken toward the reorganization of the Chicago Consolidated Traction Company. At a meeting held last week plans were developed for the unification, through routing and rehabilitation, of the five subsidiary companies of the Consolidated Traction. These steps were taken at the suggestion of Judge Grosscup, who warned the bondholders that something must be done to save the property from foreclosure sale. It is said that a new issue of approximately $6,000,000 of bonds will be made. The City Council will probably be asked for a new franchise.

Niagara Falls Power Company.—Application has been made by the Niagara Falls Power Company to the Public Service Commission of the Second District of New York for permission to issue refunding and general mortgage bonds, secured by a mortgage on all of its property, to an amount not to exceed $10,091,000. The proceeds of the bonds, to the extent of $9,076,000, are to be used for refunding outstanding obligations, and the remainder is to be used for extensions and improvements to the present plant.

Doherty Buys Knoxville Gas Company.—H. L. Doherty & Company have purchased the entire capital stock, with the exception of a few shares, of the Knoxville (Tenn.) Gas Company. The Doherty Operating Company has been operating this company for some time, and H. L. Doherty is its president. The company has outstanding $100,000 6 per cent cumulative preferred and $300,000 common stock. There are also outstanding $438,000 of 5 per cent bonds.

Houston (Tex.) Lighting & Power Company.—The stockholders of the Houston, Tex., Lighting & Power Company have voted to increase the capital stock of the company from $1,000,000 to $1,500,000. The proceeds of the new issue will be used for increasing the installation at the power station and in placing the wires under ground within the fire district of the city.

Huntington (W. Va.) Mutual Telephone Company.—The Bell interests have secured a majority of the bonds of the Huntington, W. Va., Mutual Telephone Company. This gives the Bell company control of the independent lines in that section. It is stated that the independent concern will cease to exist, and that all of the local business will pass into the hands of the Bell company.

Ohio Electric Companies Merged.—The Tiffin (Ohio) Electric Company, which was incorporated recently with a capitalization of $500,000, has absorbed the Tiffin Edison Electric Illuminating Company and the Consolidated Gas & Light Company. The consolidated corporation has reduced the price of energy 2 cents per kw-hour.

DIVIDENDS.

Boston & Northern Street Railway Company, semi-annual, 3 per cent, payable Feb. 5.

Boston Electric Railway Company, semi-annual, 3 per cent, payable Feb. 15.

Boston Elevated Railway Company, semi-annual, 3 per cent, payable Feb. 15.

East St. Louis & Suburban Railway Company, preferred, quarterly, 1¼ per cent, payable Feb. 1.

Edison Electric Illuminating Company, Boston, quarterly 2½ per cent, payable Feb. 1.

Electric Light & Power Company, of Abington and Rockland, semi-annual, 4 per cent, payable Jan. 1.

International Steam Pump Company, preferred, quarterly, 1½ per cent, payable Feb. 1.

Jacksonville, Fla., Electric Company, semi-annual, preferred and common, each 3 per cent, payable Feb. 1.

Malden (Mass.) Electric Company, quarterly, 2½ per cent, payable Jan. 15.

Old Colony Street Railway Company, Boston, preferred, semi-annual, 3 per cent, payable Jan. 10.

Philadelphia City Passenger Railway Company, semi-annual, 7½ per cent, payable Jan. 10.

Rio de Janeiro Tramway, Light & Power Company, Ltd., quarterly, 1 per cent, payable Feb. 1.

Standard Underground Cable Company, quarterly, 3 per cent, special, 14 per cent, extra, 3 per cent, all payable Jan. 10.

Twin City Rapid Transit Company, quarterly, 1½ per cent, payable Feb. 15.

J. G. White & Company, Inc., preferred, quarterly, 1½ per cent, payable Feb. 1.

General News

Construction News.

BRIDGEPORT, ALA.—The Bridgeport Electric & Railway Company, recently organized, is planning to place contracts for equipment for a 250-hp power plant within the next few weeks.

PHOENIX CITY, ALA.—The question of establishing a municipal electric-light plant is under consideration by the Town Council. A committee has been appointed to investigate the cost of the same. It is said that money for construction of the plant is available, and it is expected that plans will take definite shape in the near future.

LITTLE ROCK, ARK.—The plant and holdings of the Little Rock Telephone Company have been purchased by B. F. Kendrick, of Pine Bluff, Ark. Improvements will be made to the plant, which will involve an expenditure of about $200,000. The central-energy system will be installed and long-distance connection made with Pine Bluff. The plant is now under the same management as the Pine Bluff Telephone Company.

PALESTINE, ARK.—A company has been organized to construct and operate a telephone line from Palestine to Sloniker. T. I. Woodill is president, and Aaron Sloniker, treasurer.

SEARCY, ARK.—Preparations are being made for the construction of water works and sewerage systems, to be connected with the municipal electric-light plant, for which bonds to the amount of $80,000 have been voted. It is expected that bids will be called for the work about April 1. The system will include a deep well and electrically driven, vertical turbine centrifugal pump with a capacity of 250,000 gal; 100,000-gal. pump, and tower 100 ft. high, suction lift estimated at 50 ft. A 50-kw, three-wire, 110-220-volt, direct-current direct-connected unit will be installed when the water system is installed. W. H. Walkup is manager.

LOS ANGELES, CAL.—The City Council has granted Edwards & Wildey Company a franchise to construct a street railway on Melrose Avenue from Heliotrope Drive to Normandie.

LOS ANGELES, CAL.—Fred W. Forrester has been granted a franchise by the City Council to operate a street railway on Vermont Avenue from Muth Street to Eighth Street. Property owners have already raised a bonus of $12,000 to the Los Angeles Railway Company for the construction of the railway.

LOS ANGELES, CAL.—Plans are being prepared by the Consolidated Power & Reservoir Company, and contracts will soon be awarded for the construction of five power plants on its property in Riverside. The company has purchased 40,000 acres of land between Riverside and Corona and will construct dams and canals for irrigation purposes.

SAN JACINTO, CAL.—A. H. Koebig, civil engineer, of Los Angeles, Cal., has been engaged to make surveys and estimates preliminary to the construction of a large power plant and water system near San Jacinto. Among those interested in the project are: Grigsby & Von, of Santa Monica, Cal., and R. M. McPierson.

SAN FRANCISCO, CAL.—At an election held Dec. 30 the citizens voted in favor of the proposition to issue $1,900,000 in bonds for the construction of the Geary Street electric railway, and $120,000 in bonds for continuing the road to the Market Street Ferry. It is proposed to have the city construct an electric conduit railway from Geary and Market streets to Ocean Beach and maintain the same. The city has voted against the proposition three times in five years.

FORT LOGAN, COL.—The contract for remodeling the pumping plant to be operated by steam or electricity has been awarded to E. D. Hendrie, of Denver, Col., for $18,500.

GREELEY, COL.—Plans are being considered by J. I. Carper, of Denver, Col., for the construction of a large hydroelectric power plant west of Boulder to furnish electricity and also to supply water to irrigate thousands of acres of land in the eastern part of Weld County. The project will involve the expenditure of several million dollars. The proposed plant will have an output of 10,000 hp.

GREELEY, COL.—It is reported that as soon as the Chicago, Burlington & Quincy Railroad Company completes its circle by uniting the Colorado & Southern line from Denver to Greeley to that to be built from Greeley through to Kersey to Hudson it will tap all parts of the territory encircled with electric lines and connect them with the main line. It is understood that electricity for operating the branch railways will be secured from the plant of the Northern Colorado Power Company at Lafayette, in which, it is said, that the railroad company has a large interest. The Northern Colorado Power Company already has transmission lines erected a good distance around the railway circle, and it is said that cables for carrying energy for the branch roads will be placed on the present poles.

WASHINGTON, D. C.—Bids will be received until Jan. 18 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the navy yards and naval stations the following supplies: San Francisco, Cal., or Brooklyn, N. Y.: Schedule 2081—One horizontal, single-phase water-balance centrifugal pump. Mare Island, Cal., or Brooklyn, N. Y.: Schedule 2084—20,000 lb. galvanized sheet steel, black steel and galvanized wire. Schedule 2085—Hard and soft sheet brass, soft-rolled sheet copper. Puget Sound, Wash., or Brooklyn, N. Y.: Schedule 2085—Cold-rolled sheet copper. Indian Head, Md.: Schedule 2112—Erecting four 100-hp Babcock & Wilcox boilers and furnishing four 353-hp Babcock & Wilcox boilers. North Chicago, Ill.: Schedule 2113—Installing conduits for a telephone system at the naval training station. Brooklyn, N. Y.: Schedule 2119—5000 ft. triplex paper insulated lead-covered cable. Schedule 2123—17,000 lb. condenser tubes. Bids will also be received at the same place until Jan. 25 as follows: Schedule 2110—Three Westinghouse standard steam-driven air compressors. Boston, Mass.: Schedule 2116—Eight marine water-tube boilers and spare parts. Applications for proposals should designate the schedule desired by number.

WILMINGTON, DEL.—The Street and Sewer Department is considering the question of building a municipal conduit system. It is proposed to construct a complete system and have all overhead wires placed underground, the public service companies paying the city an annual rental for use of the conduits.

MADISON, FLA.—The Madison Electric Company contemplates making improvements and extensions to its transmission lines in the town of Madison. J. W. Reeve, Jr., is manager.

WEST PALM BEACH, FLA.—Improvements and extensions are contemplated by the Ariston Ice & Electric Company in the near future which will include the installation of an additional 60-kw generator and a high-speed Harrisburg engine. It is also proposed to make an entire change in the street-lighting system, using series tungsten lamps in place of the present arc and incandescent lamps. H. C. Adams is local manager.

GRIFFIN, GA.—Application has been made to the City Council by the Middle Georgia Interurban Railway Company to construct and operate a street-car system in this city. The company proposes to construct an electric railway from Griffin to Indian Springs, a distance of 24 miles. W. F. Smith, of Flovilla, Ga., and Captain L. W. Roberts, of Atlanta, Ga., are promoters of the project.

LAVONIA, GA.—It is reported that the city has awarded a contract for the construction of a municipal electric light plant. It is said that it is proposed to develop the water-power of upper shoals of Shoals Creek to operate the plant.

MOULTRIE, GA.—We are informed that the city has purchased a 100-kw, 60-cycle, Westinghouse generator direct-connected to a 154-hp Erie Ball engine for the municipal electric-light plant, which will replace the present 125-cycle equipment. Another unit consisting of a 30-kw generator and 50-hp engine direct-connected will be installed in the spring or early summer to provide for day service. J. M. George is chief engineer.

WAYCROSS, GA.—The property of the Waycross Electric Light & Power Company, recently taken over by the Loomis syndicate, will be operated under the name of the Waycross Gas & Construction Company. The new company will construct a new electric-light plant, which will be operated by direct-connected gas engines. A gas plant and wood-distilling plant will also be erected in connection with the electric plant, the entire cost being approximately $150,000, making a total expenditure of $200,000, including the cost of the recently acquired properties.

COEUR D'ALENE, IDAHO.—The Spokane, Wallace & Interstate Railway Company, it is reported, will apply for a street railway franchise in Coeur d'Alene at the next meeting of the City Council. Surveys have been completed and options have been obtained on much of the right-of-way between Coeur d'Alene and Wallace. F. F. Johnson is president.

TWIN FALLS, IDAHO.—The Twin Falls Electric Railroad, Light & Power Company has secured a franchise to construct and operate a street railway in Twin Falls. George F. Sprague and W. P. Guthrie are interested in the project.

AURORA, ILL.—Plans are being considered by the Chicago, Aurora & DeKalb Railroad Company for the construction of two substations.

CHICAGO, ILL.—The first definite steps toward the unifications, through routing and rehabilitation of the Chicago Consolidated Traction Company's lines and its working agreement with the Chicago Railways Company were taken at a meeting held Jan. 7. New franchises will be asked of the City Council for five of the North Side subsidiary companies, all of whose franchises expire within seven years. Plans were also formulated for a rehabilitation bond issue of approximately $6,000,000 as soon as the old franchises are renewed.

EAST ST. LOUIS, ILL.—Orders have been placed by the American Steel Foundries Company with the Allis-Chalmers Company for an additional generating unit, consisting of a 16 x 26 x 36 tandem-compound, non-condensing engine direct-connected to a 300-kw, 250-volt, direct-current generator.

FARMINGTON, ILL.—The Farmington Electric Light Company is planning to establish a day service about March 1. The company is at

present operating at 125 cycles, but machines have been installed for 60 cycles. Theodore Bass is owner and manager.

HEYWORTH, ILL.—The Heyworth Electric Light & Power Company is planning to build three two-mile transmission lines into the country next spring. The company also contemplates the construction of a new power plant. Charles Crump is manager.

LOUISVILLE, ILL.—Plans are being considered to extend the transmission lines of the municipal electric-light plant to "Jimtown" to furnish electricity for lamps. I. N. Stanford is manager.

ROCK ISLAND, ILL.—The Standard Oil Company of New York, N. Y., is making changes to its power plant in Rock Island and has placed contracts with the Allis-Chalmers Company, of Milwaukee, Wis., for equipment, as follows: One 20 x 42 non-condensing, heavy-duty engine operating at 100 r.p.m. under a steam pressure of 100 lb.; one 100-kw, 600-volt, three-phase, 60-cycle, 900-r.p.m. alternator; also a four-panel switchboard.

SPRINGFIELD, ILL.—The Springfield & Jacksonville Electric Railway Company has awarded the contract for the construction of its proposed electric railway between Springfield and Jacksonville, 33 miles in length, to the J. H. McFarland Company. Work will commence on construction of the road as soon as the weather will permit.

INDIANAPOLIS, IND.—Application has been made to the County Commissioners for an electric railway franchise over Churchman Pike, between Indianapolis and Beech Grove. The Shore Line Traction Company has also applied for a franchise over the same route.

INDIANAPOLIS, IND.—The contract for furnishing the lighting fixtures for the new city hall was awarded by the Board of Public Works to the Sanborn-Marsh Electric Company, of Indianapolis, Ind., for $23,294. The Otis Elevator Company secured the contract for elevators at $9,500.

INDIANA HARBOR, IND.—The American Steel Foundries Company has recently placed a contract with the Allis-Chalmers Company, of Milwaukee, Wis., for a new generating unit, including a 16 x 26 x 36 tandem-compound, non-condensing engine direct-connected to a 300-kw, 250-volt, direct-current generator.

MUNCIE, IND.—Arrangements are being made by the Muncie Glass Company to rebuild its plant, recently destroyed by an explosion. The plant will be equipped with electrical apparatus wherever possible.

RICHMOND, IND.—The report of the municipal electric-lighting plant for 1909 shows a gain in business for the year of $12,510. The total receipts for the year were $45,361 in excess of operating expenses, which is the best showing the plant has ever made. The total disbursements for the year were $53,461. The city is now taking steps to purchase the water-works plant with a view of operating it in connection with the electric plant.

SHELBYVILLE, IND.—It is reported that plans are being considered to consolidate the plants of the Citizens Water & Light Company and the Shelbyville Gas Light Company. It is said that Petry & Company, bankers, of Chicago, Ill., propose to purchase both systems and to erect and equip a new station and combine the two plants.

BEDFORD, IA.—Plans are being prepared by the Bedford Light, Heat & Power Company to establish a day service. The company will either change its equipment to 60-cycle, three-phase, or install direct current for power service and retain the 133-cycle, single-phase system for lamps and small motors. It is proposed to change the present street lamps for tungsten-series 60-cp lamps. Arc lamps will be replaced with clusters of four 60-cp tungsten lamps. The company also contemplates extending its lighting system to Gravity and Conway. M. L. Burt is president and manager.

FARRAR, IA.—An independent telephone company has been organized by the farmers residing in and near the town of Farrar. It is capitalized at $5,000, and the officers are: J. T. Dunlap, president; Asa Turner, vice-president, and H. E. Fleagle, secretary and treasurer, all of Farrar.

GRINNELL, IA.—Negotiations have been closed whereby the Iowa Telephone Company has taken over the toll lines of the Long Distance Copper Telephone Company.

HARTLEY, IA.—Sealed bids will be received by the town of Hartley until Jan. 20 for a storage battery for lighting purposes. R. E. Lampman is superintendent of the municipal light and water department.

LEON, IA.—Plans are under consideration by S. C. Johnston and J. F. Smith, owners of the Leon Electric Company, for the construction of an electric railway from the Chicago, Burlington & Quincy Railroad depot to the business section of this city, to be extended as requirements demand.

WATERLOO, IA.—The Waterloo, Cedar Falls & Northern Railway Company has placed an order with the Allis-Chalmers Company for extensive switchboard equipment in addition to orders for machinery previously placed. The main switchboard will be located at Galloway and will have 26 panels. Each of the three substations will be furnished with a three-panel board.

ANTHONY, KAN.—The plant of the Citizens' Improvement Company has been purchased by the City of Anthony and is now operated by the municipality. The electric-light plant and water-works system are combined, the same boilers furnishing steam for both. A 24-hour service has also been established. Otis Law, commissioner of public utilities, has charge of the plant. Louis L. Hotton is chief electrician.

ASHLAND, KAN.—Plans and specifications are being prepared for a water and lighting system in Ashland, Kan., bids for the construction of which will probably soon be called. The J. S. Worley Company, engineers, 206 Reliance Building, Kansas City, Mo., have charge of the engineering work.

WICHITA, KAN.—It is reported that preliminary arrangements have been completed by the Motor Grand Traction Company for the construction of an interurban railway from Chester, Neb., to Wichita, Kan. T. S. Alnutt, of Belleville, Kan., is promoter.

FULTON, KY.—The Court of Appeals has handed down an opinion under which the plant of the Fulton Electric Light & Power Company is to be sold at auction. Owing to a dispute over the management of the plant the stockholders owning 50 per cent of the stock applied to the court to take the control of the plant from L. W. Graham, who owns the other 50 per cent of the stock, and sell it at auction in order to settle the disagreement. The plant is valued at $45,000 and furnishes the entire electrical service in Fulton. The other stockholders are: C. E. Rice, Joseph Browder, R. A. Freeman and J. H. McClure.

CLINTON, LA.—The City Council has decided to purchase the electric-light plant of the Clinton Cotton Oil & Manufacturing Company for $13,000. It is said that the machinery will be removed to a new building located near the present plant. John Levy is Mayor.

BALTIMORE, MD.—Sealed proposals will be received at the office of J. Sewell Thomas, city register, City Hall, Baltimore, Md., until Feb. 9 for constructing power house, pump house and land conduits and underwater discharge conduits at the Back River disposal works, in accordance with plans and specifications on file in the office of Calvin W. Hendrick, chief engineer of the Sewerage Commission. Peter Leary, Jr., is chairman of Sewerage Commission.

BOSTON, MASS.—The auxiliary power station of the Boston Elevated Railway Company, located at 530 Harrison Avenue, was destroyed by fire Jan. 3, causing a loss of about $50,000.

BOSTON, MASS.—Beginning Jan. 1 the Edison Electric Illuminating Company, of Boston, will reduce the price of electricity for lamps from 12 cents per kw-hour to 11 cents per kw-hour.

CHICOPEE, MASS.—Plans are being considered by the Board of Water Commissioners for new equipment for the Fairview water-works pumping station, bids for which have been asked. It is proposed to install a gas engine to operate the pumps; electricity will also be used. The gas engines will be installed as soon as possible; the electrical equipment will be installed later.

GREAT BARRINGTON, MASS.—The Great Barrington Electric Light Company is considering the question of substituting tungsten lamps for those now in use. P. A. Russell is vice-president and manager.

REVERE, MASS.—The Suburban Gas & Electric Company has applied to the State Board of Gas and Electric Commissioners for permission to issue $169,600 additional capital stock at $120 per share, the proceeds to be used to refund floating indebtedness incurred in making enlargements to its system.

MARINE CITY, MICH.—The Marine City Roller Mill Company is contemplating changing its system from 125 cycles to 60 cycles this coming spring. Eber Arnold is secretary and manager.

MIDLAND, MICH.—It is reported that a series of seven dams developing thousands of horse-power will be erected on the Tittabawassee River between Edenville, Midland County, and a point in Gladwin County during the coming summer. It is proposed to use the power developed in the above-named counties and in Saginaw and Bay counties. The project, it is said, includes the extension of the Michigan Central Railroad from Midland to Edenville and Hope. Frank Wixson, of Salina, Mich., is reported interested in the project.

NILES, MICH.—Preparations are being made by the Michigan State Telephone Company for the construction of a telephone exchange building in Niles, which with equipment will cost about $25,000. A switchboard capable of handling 1500 telephones will be installed.

PONTIAC, MICH.—The Detroit Edison Company, which was denied permission to enter Pontiac, except on acceptance of a franchise, has decided to erect a power house outside of the city limits and connect its feed wires with the Detroit United Railway system without entering the city.

FAIRBAULT, MINN.—H. M. Byllesby & Company, of Chicago, Ill., who recently purchased the property of the Fairbault Gas & Electric Company and the Cannon Falls water power, have purchased the plant and holdings of the Polar Star Electric Company. The two plants, it is said, will be consolidated.

FERGUS FALLS, MINN.—It is reported that the Otter Tail Power Company is placing contracts for another complete unit in its electrical plant. The company proposes to install 60 more arc lamps for street lighting purposes.

LAKE CITY, MINN.—The Lake Pepin Telephone Company has been incorporated to take over the system of the Pepin Telephone Company. Plans are being prepared to make permanent improvements to the plant. G. Dwelle is secretary and treasurer.

LITTLE FALLS, MINN.—The construction of an electric railway from Little Falls to Alexandria, via Long Prairie, is under consideration. Negotiations are under way with the local water power company to furnish power to operate the system. Henry Diebel, of Long Prairie, is interested in the project.

LUVERNE, MINN.—Preparations are being made by the Luverne Telephone Company to commence work on the installation of underground conduits in the spring.

MIDDLE RIVER, MINN.—A movement is on foot to form a company for the purpose of erecting a telephone line to Gatzke. A. C. Kyennes, Henry Young and others are interested in the project.

SAUK CENTER, MINN.—The Northwestern Telephone Company is reported to be considering rebuilding its local plant.

WABASHA, MINN.—The Dwelle Telephone Company is contemplating the installation of a new telephone system.

ST. JOSEPH, MO.—The St. Joseph Railway, Light, Heat & Power Company is extending its transmission lines to Elwood and Wathena, to furnish electricity for lamps and motors in both places. The City Council has granted the St. Joseph Railway, Light, Heat & Power Company a 35-year franchise for the construction of a street railway into Northwest St. Joseph, and also for the extension of the Frederick Avenue line from Twenty-sixth Street for a distance of several hundred yards.

ST. LOUIS, MO.—The St. Louis & Kansas City Electric Railroad Company, which is planning to construct an electric railway between St. Louis and Kansas City, is reported to have completed negotiations for a power plant to be located about half way between its terminals.

WEBB CITY, MO.—Orders have recently been placed by the Southwest Missouri Railway Company with the Allis-Chalmers Company, of Milwaukee, Wis., for electrical equipment for its new cars, including car motors, together with controllers, wiring, etc. The motors are of the new interpole type manufactured by the Allis-Chalmers Company.

COLUMBIA FALLS, MONT.—The City Council has granted the Northern Idaho & Montana Power Company a 50-year franchise to furnish electricity in Columbia Falls from the large plant at Big Fork, through the Kalispell station.

DAVID CITY, NEB.—Bonds to the amount of $40,000 are being offered for sale by the city of David City, of which the proceeds of $20,000 will be used for an electric-light system. T. B. Meyers is city clerk.

GREGORY, NEB.—A company has been formed by local men for the purpose of furnishing electricity in Gregory. The capital stock of the company is placed at $20,000. The officers are: W. H. Tackett, president; J. Reuther, vice-president; Edward Morrison, secretary, and John P. Biehn, treasurer.

ANTRIM, N. H.—The Goodell Company, of Antrim, has filed an amendment to its charter, giving the company the right to purchase and utilize water-powers for the development of electricity for its own use and to supply electrical energy for lamps and motors, also to engage in all forms of power generation and transmission.

DERRY, N. H.—The Derry Electric Light Company is making arrangements to discard its direct-current machines and to replace them with three-phase, 60-cycle, alternating-current generators. The generator has already been installed and the company is now changing its wires for the new system.

RAYMOND, N. H.—Plans are being made by the Raymond Electric Company to install a 60-kw generator. About April 1 the company will install a hydroelectric power plant, with an output of 200 hp, about two miles distant from the present steam plant. Charles F. Gardiner is manager.

BLOOMFIELD, N. J.—Mayor Sutphen, of Bloomfield, in his annual message to the Town Council, recommends the purchase of the electric light and power equipment of the Public Service Corporation, which now furnishes electrical service in this town. Under the terms of the franchise held by the company, which expires next year, the town has the privilege of purchasing the system at the expiration of the franchise. The five-year contract for public lighting expires at the same time. At present the town is paying $70 each per year for arc lamps of 1200 cp and $16 each for 30-cp incandescent lamps.

MONTCLAIR, N. J.—We are informed that William H. Schoonmaker was appointed chairman of the committee to make investigations regarding the establishment of a municipal electric-light plant in Montclair. No definite action will be taken in the matter before next summer. Harry Trippet is town clerk.

PORTALES, N. M.—Bids will be received at the office of Herbert B. Ryther, town clerk, Portales, N. M., until Jan. 26 for furnishing material and constructing water works, electric lighting and sewer systems, separate bids being entertained as follows: 1. For furnishing material and labor (except such material as is separately itemized in this notice), and constructing complete systems of water works and electric lighting. 2. For furnishing all material and labor and constructing a complete sewer system, including pumping station and septic tank. 3. For furnishing material and labor and erecting a steel tower and tank of 50,000-gal. capacity, 125 ft. high. 4. For furnishing f.o.b. cars Portales, N. M., two three-phase, 60-cycle, 2300-volt generators rated at 75 kw and 50 kw, respectively; switchboard, motors and electrical equipment. 5. For furnishing and installing two gas-producer units, including engines for operating electrical units mentioned under division 4. Plans and specifications for the above work are on file at the office of the town clerk, Portales, N. M., and at the office of Burns & McDonnell, engineers, 823 Scarritt Building, St. Louis, Mo. Extra copies of the plans may be secured from engineers on payment of $5 to cover the cost of the prints. W. E. Lindsey is chairman board of trustees.

AMITYVILLE, N. Y.—The Amityville Electric Light Company is contemplating the installation of another electrical unit and changing the frequency.

CLAYVILLE, N. Y.—At a meeting of the taxpayers held recently it was decided to have the new lighting system installed at once, poles for which are being erected. It is expected to have the system in operation by March 1.

HASTINGS-ON-HUDSON, N. Y.—Orders have been placed by the National Conduit & Cable Company with the Allis-Chalmers Company, of Milwaukee, Wis., for 13 induction motors varying in size from 15 to 75 hp. A steam turbine unit made by the Allis-Chalmers Company is now being installed.

NEW PALTZ, N. Y.—S. L. Johnston, secretary and manager of the Electric Light Company, of New Paltz, writes that the company now purchases electricity for operating its system from the Hudson Counties Gas & Electric Company, which is furnished at 33,000 volts, three-phase, reduced to 2300 volts, two-phase, and distributed single-phase. He also states that the power-house equipment, consisting of boiler, engine and two dynamos, are for sale.

NIAGARA FALLS, N. Y.—The Niagara Falls Hydraulic Power & Manufacturing Company has placed an order with the Allis-Chalmers Company for two 6500-kw, 12,000-volt, 25-cycle, hydraulically driven revolving-field generators. These machines will be duplicates of the two already installed by the Allis-Chalmers Company.

NIAGARA FALLS, N. Y.—Application has been made to the Public Service Commission, Second District, by the Niagara Falls Power Company, of Niagara Falls, N. Y., for permission to issue bonds not to exceed $10,091,000, the proceeds of $9,076,000 to be used for refunding of obligations, and the remainder for extensions and improvements to its present plant.

SYRACUSE, N. Y.—The Onondaga Independent Telephone Company has decided to make extensive improvements to its service, including the extension of both its local and long-distance lines, work on which will commence as soon as the weather will permit. The cost of the work is estimated at $150,000. Alexander H. Cowie is president of the company.

TOMKINS COVE, N. Y.—Extensive additions and improvements are being made to the stone-crushing plant of the Tomkins Cove Stone Company in Tomkins Cove. The power equipment has been purchased from the Allis-Chalmers Company, of Milwaukee, Wis., and will include one 22 x 44 x 42 heavy-duty, cross-compound condensing engine running at 100 r.p.m. under 150-lb. pressure; an 18 x 36 x 36 heavy-duty, cross-compound condensing engine running 107 r.p.m. direct-connected to a 500-kva generator, which will furnish electricity for lamps and motors. Twelve 25-cycle, 550-volt, three-phase induction motors ranging in size from 10 to 150 hp will be used for driving machines in various parts of the plant.

UTICA, N. Y.—The Public Service Commission, Second District, has granted the Utica & Southern Railway Company permission to build an extension from the south line of the village of Hamilton to and through the village of Sherburne and to the south line of Norwich.

ALBERMARLE, N. C.—The Southern Power Company is erecting a substation near the Wiscasset Mills to furnish electricity to operate the new mills of the company.

GASTONIA, N. C.—The Piedmond Telephone Company has purchased the property of the South Point Telephone Company and will reorganize the system. T. L. Allison will be business manager.

HENDERSONVILLE, N. C.—The Hendersonville Light & Power Company is planning to begin work on the construction of its proposed extension, about 4½ miles in length, this coming spring. R. M. Oates, of Hendersonville, is president.

LEXINGTON, N. C.—Plans are being considered to change the system of the municipal electric-light plant from direct to alternating-current, and purchasing electricity for operating the plant from the Southern Power Company, of Charlotte, N. C. Albert L. Couch is superintendent.

SYLVA, N. C.—Arrangements are being made by Charles J. Harris to erect an electric plant on the Huckaselgee River, a short distance from Dillsboro, to furnish electricity for lamps in Sylva and Dillsboro. It is expected that street lamps will be installed in Sylva.

WILSON, N. C.—New equipment has been installed in the municipal electric-light plant, changing the system from 1100-volt, 133-cycle, single-phase to 2300-volt, 60-cycle, three-phase. C. E. D. Egerton is superintendent.

BEACH, N. D.—Application has been made to the Council by George S. Chrysler, superintendent of the Wadena municipal electric-light plant, for a franchise to install an electric-light plant in Beach.

FARGO, N. D.—The City Council has passed a resolution calling an election to be held Jan. 28 to vote on the proposition to issue $90,000 in bonds, the proceeds to be used for a new filtration plant and electric-light plant.

GRAND FORKS, N. D.—We are informed that the Grand Forks Street Railway Company expects to purchase second-hand power house equipment complete, to generate from 200 to 300 kw. Thomas D. Campbell is general manager.

MINOT, N. D.—The capital stock of the Northern Telephone Company has been increased from $10,000 to $20,000.

DAYTON, OHIO.—The Dayton Computing Scales Company has acquired the site formerly occupied by the Dayton Hydraulic Machinery Company in Dayton, and proposes to erect a large manufacturing plant, which will be equipped with electric motor-driven machinery.

NEW PHILADELPHIA, OHIO.—Improvements are being made to the water-power facilities of the Tuscarawas County Electric Light & Power Company. The company is also contemplating increasing the output of its plant by the installation of a 200-kw, three-phase, 2300-volt, alternating-current unit. P. Barnhard is manager.

TIFFIN, OHIO.—The Tiffin Electric Company, recently incorporated, with a capital stock of $500,000, has absorbed the Tiffin Edison Electric Illuminating Company and the Consolidated Gas & Light Company. A reduction of 2 cents per kw-hour in the price of electricity has been made by the new company, to take effect from Jan. 1. The officers of the new corporation are: R. E. Breed, of Marion, Ind., president; George N. Tidd, of Elizabeth, N. J., vice-president; John H. Ormond, of Toledo, Ohio, secretary, and Frank B. Ball, of Plainfield, N. J., treasurer.

ZANESVILLE, OHIO.—We are informed that the Muskingum & Morgan Railway, Light & Power Company is planning to commence work on the construction of its proposed railway early in the spring. The railway will connect Zanesville and Duncan Falls. The company is capitalized at $10,000. W. H. Pierpont, of Zanesville, O., is secretary.

DURANT, OKLA.—At an election held Dec. 28 the citizens voted to issue $40,000 in bonds, of which the proceeds of $20,000 will be used for an electric-lighting system. The Southwestern Engineering Company, of Oklahoma City, Okla., has charge of the engineering work.

TISHOMINGO, OKLA.—Plans are being considered by the Board of Trustees for the installation of an electric-light plant to furnish electricity for lamps, heat and power in Tishomingo. The plant will be operated by water-power and will have an output sufficient to supply from 1000 to 1200 lamps. About 15 miles of wires will be erected. W. H. Bingham is president Board of Trustees.

WALTER, OKLA.—We are informed that bids will be called about Jan. 24 for the construction of water and lighting systems. Bonds to the amount of $90,000 have been voted, of which the proceeds of $7,000 will be used for the lighting system.

PORTLAND, ORE.—The Portland Railway, Light & Power Company has awarded the contract for the construction of the foundation for its proposed new power plant on the river front at East Lincoln Street to the Pacific Engineering Company. It is expected to have the plant completed and in operation by next September.

ERIE, PA.—The Erie & Union Railroad Company has filed a mortgage for $1,000,000 at the office of the Recorder of Erie County in favor of the Carnegie Trust Company, of New York, N. Y., to secure an issue of bonds. The company proposes to construct an electric railway connecting Erie with Union City, Cambridge Springs, Corry, Titusville and other cities, for which the company has secured the rights-of-way.

NEW CASTLE, PA.—The City Council has refused for the present to grant the Delaware Water Improvement Company permission to erect additional poles and wires in the city to carry cables to Fort du Pont, on the ground that too many franchises are given away.

SCRANTON, PA.—It is reported that the Delaware, Lackawanna & Western Railroad Company is contemplating equipping a portion of its road to be operated by electricity, which may possibly be carried out this year. The plans call for installing electric locomotives on the various suburban lines of the company, while heavy electric locomotives will be used for handling freight over the steep grades in the vicinity of Scranton. T. E. Clark is general superintendent of the company.

SLATINGTON, PA.—The Franklin & Towamensing Street Railway Company is planning to commence work on the construction of its proposed electric railway, which will connect Slatington, Palmerton, Bowmans, Parryville, Weissport, Lehighton and Mauch Chunk, Pa. A. P. Berlin, of Slatington, Pa., is president.

WAYNESBURG, PA.—The Waynesburg & Blacksville Street Railway Company is reported to have awarded a contract to W. A. Martin for the construction of the section of its proposed railway between Blacksville and Morgantown. The contract for the construction of the division between Manington and Blacksville has also been awarded. A power station will be erected at Blacksville. The main line of the railway will be 14 miles in length and will extend from the Pennsylvania-West Virginia State boundary to Waynesburg, Pa. Extensions will be built which will total about 50 miles.

WEST NEWTON, PA.—Negotiations have been closed whereby the Borough Council has sold the borough municipal electric light plant to the West Penn Company, for which the borough is to receive the sum of $14,000. Under the new ownership consumers will be supplied with electricity for lamps at a maximum rate of 10 cents per kw-hour. It is understood that the company will enlarge the plant and extend the system. The general offices of the West Penn Company are located in Pittsburgh, Pa.

GREERS, S. C.—The contract for lighting the streets and public buildings has been awarded to A. H. Miller, who proposes to install an electric-lighting system in this town. Electricity for operating the system will be furnished by the Southern Power Company, of Charlotte, N. C. Under the contract arc lamps will be furnished at the rate of $67.50 each per year.

RIDGEVILLE, S. C.—It is reported that a large fertilizer plant is to be erected on the Edisto River near Ridgeville, S. C., at a cost of $10,000,000. A hydroelectric power plant will be erected in connection with the enterprise. D. G. Zeigler, of Jacksonville, Fla., is reported interested in the project.

HECLA, S. D.—It is reported that Twaddle Brothers are contemplating the installation of an electric-light plant in their feed mill on Second Avenue to supply electricity for lamps in the town of Hecla.

LEMMON, S. D.—Plans are being considered by the Lemmon Home Telephone & Telegraph Company for extensions to its telephone lines during the coming year.

WILLOW LAKE, S. D.—Thomas A. Felix has secured a franchise to install an electric-light plant in Willow Lake.

CAMDEN, TENN.—The Camden Electric Light Company, it is said, will soon call for bids for a generating unit and other machinery for its power plant.

CLARKSVILLE, TENN.—It is reported that the Clarksville Railway & Light Company is contemplating extending its railway to New Providence and Dunbar's Cave. It is stated that the holdings of the Clarksville Railway & Light Company have been purchased by interests represented by E. L. Fischer, of Danville, Ill.

MEMPHIS, TENN.—The Larkin Company, of Buffalo, N. Y., which is increasing the output of its power plant at its branch factory in Memphis, Tenn., is reported to have placed orders for a 300-kw generating unit and auxiliary apparatus.

HOUSTON, TEX.—The capital stock of the Houston Lighting & Power Company has been increased from $1,000,000 to $1,500,000. It is stated that improvements are contemplated, including the installation of additional equipment in power station and placing its wires underground in the fire district. An appropriation of $100,000 was made some time ago for placing the wires underground.

GRANBURY, TEX.—The City Council has granted the Acton Telephone Company a franchise to erect and operate a telephone system in Granbury. The company is making arrangements to extend its line into Granbury at an early date.

COALVILLE, UTAH.—Plans are being made by Moses W. Taylor, of Coalville, to organize a company for the purpose of developing the water-power of Chalk Creek, to be used to generate electricity for transmission to various towns in Utah. The cost of the work is estimated at about $25,000. The company will be probably known as the Coalville Power, Light & Heating Company. T. J. Yates, of Salt Lake City, Utah, is engineer.

MARYSVALE, UTAH.—Plans are being considered by the Belknap Power Company for the construction of a hydroelectric power plant in the Sevier River country to supply electricity for lamps and motors for the settlers, towns and mines in the Gold Mountain and Marysvale districts. The cost of the plant is estimated at about $3,000,000. The plant will develop from 6000 hp to 7000 hp. It will be located near Marysvale in Piute County. James Long is president of the company, and J. B. Weimar is interested in the project.

FAIRHAVEN, VT.—The Rutland Railway, Light & Power Company, of Rutland, Vt., is reported to have taken a 10-year lease of the property of the Fairhaven Electric Company, which furnishes electricity for lamps in Fair Haven, Poultney and vicinity. Power for operating the plant of the Fairhaven company is obtained from Carvers Falls on the Poultney River.

MONTPELIER, VT.—George Dalrymple, of Fair Haven, Vt., who has the contract for constructing the penstock for new plant of the Corry, Deavitt & Frost Electric Company, is making arrangements to begin work at once on same.

BEDFORD CITY, VA.—At an election held Jan. 4 the citizens voted to issue $100,000 in bonds, the proceeds to be used for the construction of a municipal electric-light plant in Bedford, Va. W. R. Abbott is city attorney.

PENNINGTON GAP, VA.—The Monarch Coal Company, it is said, is planning to rebuild its power house, which was destroyed by fire, causing a loss of about $6,000.

BELLINGHAM, WASH.—The Farmers' Mutual Telephone Company, it is reported, is contemplating improvements to its system in Bellingham and vicinity, which will involve an expenditure of about $6,000.

BELLINGHAM, WASH.—Preparations are being made by the Whatcom County Railway & Light Company for the construction of an auxiliary power plant, work on which will soon commence. New machinery sufficient to develop 3000 hp will be installed, which with the equipment of the present auxiliary station will give the plant an output of 4500 hp. The equipment will include a 2000-kw steam turbine and boilers of 1000 hp. It is understood that contracts for equipment of this plant have not yet been placed.

MANSFIELD, WASH.—A project is on foot to take over the entire telephone system of Douglas County, to be operated by one company, to be capitalized at $10,000. It is said that the company proposes to erect a trunk line from Waterville to Mansfield, also from Mansfield to Bridgeport and Goulee City.

WHITE SALMON, WASH.—Preparations are being made by the Mt. Adams Electric Railroad Company for the construction of its proposed electric railway from White Salmon and Glenwood, about May 1, a distance of about 60 miles. C. L. Colburne, of White Salmon, Wash., is secretary.

MIDDLEBOURNE, W. VA.—It is reported that I. M. Underwood, of Middlebourne, W. Va., is interested in a project to construct an electric railway from Middlebourne to Sistersville.

RONCEVERTE, W. VA.—A charter has been recently granted to the Ronceverte Milling Company, which includes the privilege of erecting a dam across the Greenbrier River and the construction of electric and water plants. The company is capitalized at $50,000, and the incorporators are: John G. Fulton, of Grettes, W. Va.; Oscar A. Price, James R. Johnson, James Winkler, Jr., and W. H. Kauffelt, all of Ronceverte, W. Va.

WHEELING, W. VA.—The Board of County Commissioners has granted the Rapid Transit Railway Company a franchise to construct an electric railway through Ohio County.

BROWNTOWN, WIS.—The Browntown Telephone Company has filed an amendment to its charter increasing its capital stock from $5,500 to $19,800.

GALESVILLE, WIS.—The La Crosse Water Power Company has applied for a franchise to extend its transmission lines into Galesville.

JANESVILLE, WIS.—The Cincinnati Construction Company has been granted a certificate of public convenience and necessity by the State Commission, giving it permission to proceed with the construction of its electric railway between Madison and Janesville.

NEILLSVILLE, WIS.—Plans are being prepared by the Upham Manufacturing Company for the construction of an electric power plant on the Black River in Neillsville, which will develop 400 hp. The Upham company, it is said, will utilize 250 hp, and the remainder will be used by the Spaar Cereal Company to operate its flour mill.

NEW RICHMOND, WIS.—It is reported that plans have been prepared for O. W. Mosher, of New Richmond, for the installation of a 600-kw power plant to be driven by hydraulic turbines direct connected to electric generators.

SHEBOYGAN, WIS.—Arrangements are being made by the J. M. Kohler Sons' Company for the construction of a large power plant in connection with its manufacturing plant at Riverside. The equipment of the power-house will include a 1000-hp cross-compound condensing engine direct-connected to a 750-kw Crocker-Wheeler generator; auxiliary equipment, including a 375-hp Corliss engine direct-connected to a 250-kw generator, and one 150-hp Corliss engine belted to a 150-kw generator will be installed.

LETHBRIDGE, ALTA, CAN.—The municipal electric light plant is reported to have been totally destroyed by fire on Jan. 4, leaving the city without electric lighting or water service.

KELOWNA, B. C., CAN.—The Coteau Power Company, through its representative, Mr. Warren, is negotiating with the Town Council of Kelowna, B. C., for a franchise to furnish electricity for lamps and motor and electric railway system in Kelowna. Mr. Warren stated that the company proposes to develop a water power at Shuswap Falls and transmit electricity through the Okanagan Valley between the towns of Enderby and Penticton, and to construct and operate an electric railway through the same district. If the project is endorsed by the different municipalities, it is expected that about $2,000,000 would be expended on the different propositions proposed. The Council has passed a resolution favoring the submitting to the ratepayers of a by-law granting a franchise to the company for a period of 25 years for electric light and power system and tramway lines, provided the systems would be completed in time to move the crops in 1911.

MISSION CITY, B. C., CAN.—The Mission City Telephone Company is contemplating making extensons to its system.

BRAMPTON, ONT., CAN.—At an election held Jan. 3 the citizens voted in favor of the by-law providing for a contract with the Hydro-Electric Power Commission and to issue debentures for $40,000, the proceeds to be used for the construction of a distributing plant.

BRIDGEBURG, ONT., CAN.—A by-law granting the Canadian Niagara Power Company, of Niagara Falls, Ont., a franchise to extend its transmission lines into Bridgeburg was carried at an election held recently. The by-law does not bind the village to purchase electrical service, but gives it the privilege of doing so, at a fixed price, should it desire to do so.

COBALT, ONT., CAN.—The Mines Power Company, Ltd., which is constructing a hydroelectric power plant on the Matabinchonawa River expects to be able to supply electricity in Cobalt in the near future.

INGERSOLL, ONT., CAN.—At an election held Jan. 3 the citizens defeated the proposition to appropriate $30,000 for the construction of an electrical distributing plant.

KINGSTON, ONT., CAN.—The by-law to confirm the agreement between the city and the Trenton Electric & Water Power Company for a franchise to furnish electricity to light the city for a term of three or five years was carried at an election held Jan. 3.

NORWICH., ONT., CAN.—The by-law authorizing the municipality to secure electricity from the Hydro-Electric Power Commission was carried at an election held Jan. 3.

PETERBORO, ONT., CAN.—The by-law authorizing the City Council to enter into an agreement with the Peterboro Light & Power Company for a term of 30 years was carried at an election held Jan. 3.

PORT ARTHUR, ONT., CAN.—The by-law authorizing the City of Port Arthur to enter into a contract with the Hydro-Electric Power Commission was carried at an election held Jan. 3. An injunction had been granted restraining the city from entering into a contract with the Hydro-Electric Commission on the ground that the contract was irregular and contrary to law.

STRATFORD, ONT., CAN.—At an election held Jan. 3 the by-law to appropriate $108,000 to purchase the electric-light plant of the Stratford Gas Company, to be operated by the municipality, was defeated.

TORONTO, ONT., CAN.—It is reported that W. H. Price, of Toronto, is planning the organization of a company to construct an electric railway from Toronto to Barrie, with branches to Orilla and Owen Sound, via Medford, a distance of over 150 miles. Application will be made for a charter at the next session of the Legislature.

REGINA, SASK., CAN.—The City of Regina desires to enter into negotiations with capitalists and others for the purpose of obtaining proposals for a special franchise for street-car service and gas works for the city, subject to the right of the city to take over the undertaking at the expiration of a definite term of years, at a price to be fixed by arbitration or in such manner as may be agreed upon. Angus Smith is city engineer.

New Industrial Companies.

THE AMERICAN ENGINEERING & CONSTRUCTION COMPANY has filed articles of incorporation with a capital stock of $250,000. The incorporators are: C. M. Townsend, T. J. Bowen, Jr., and F. H. Hoffecker, of Wilmington, Del.

THE CHAMPLIN & NORTON MANUFACTURING COMPANY, of Plainfield, Conn., has filed articles of incorporation for the purpose of manufacturing electrical appliances, some of which are patents of the incorporators. The company is capitalized at $10,000. The incorporators are: Minton A. Norton, Harvey M. Williams, J. L. Burton and F. S. White, of Plainfield, and F. A. Champlin, of East Longmeadow, Mass.

THE ELLCORN CONSTRUCTION COMPANY, of Jersey City, N. J., has been incorporated by H. O. Coughlan, S. A. Anderson and B. S. Mantz, of Camden, N. J. The company is capitalized at $200,000 and proposes to do a general construction and engineering business.

THE GENERAL BALL-BEARING COMPANY, of Camden, N. J., has been chartered with a capital stock of $500,000 by J. A. MacPeak, W. F. Eidell and F. R. Hansell, all of Camden, N. J. The company proposes to manufacture ball and roller bearings.

THE MACHINERY EQUIPMENT COMPANY, of New York, N. Y., has been incorporated with a capital stock of $10,000 by George F. Baker, Nathan F. Ciffin and Robert C. McWane, all of New York, N. Y. The company proposes to deal in machinery, engines, motors, etc.

THE PACIFIC X-RAY COIL MANUFACTURING COMPANY, of Seattle, Wash., has been incorporated with a capital stock of $10,000 by F. L. Heidrich and others.

THE ANDREW J. ROBINSON COMPANY, of Bangor, Maine, has been incorporated with a capital stock of $10,000 to deal in electrical and mechanical devices. The incorporators are: Walter J. Hurley, president; Andrew J. Robinson, treasurer, and Ralph N. Bicknell, of Bangor, Maine.

THE SPECIALTY MANUFACTURING COMPANY, of Pittsfield, Mass., has been incorporated by Michael Casey, of Pittsfield, Mass., and John E. Wood, of Dalton, Mass. The company is capitalized at $10,000 and proposes to manufacture insulating material.

THE TELEPHONE AUDITING & ADJUSTING SOCIETY OF THE STATE OF NEW YORK, of New York, N. Y., has been incorporated for the purpose of establishing a system of auditing and adjusting accounts between telephone companies in order to enable the members of the society to protect themselves against overcharges for services rendered by telephone companies. The directors are: N. Siegel, David Brayer and Solomon Marculescu, of New York, N. Y.

New Incorporations.

McHENRY, KY.—The Ohio County Farmers Mutual Telephone Company has been chartered with a capital stock of $2,400 by E. G. Austin, W. P. Hunley and J. C. Chinn.

DOYLESTOWN, PA.—The Plumsteadville Rural Telephone Company has been organized with the following officers: H. D. Rosenberger, president; Isaac S. Goss, secretary, and Henry Shelly, treasurer.

TOWANDA, R. F. D. NO. 8, PA.—The Fairview Independent Telephone Company has been incorporated with a capital stock of $10,000 by John Morley.

GREENVILLE, S. C.—The Greenville, Spartanburg & Anderson Traction Company has been incorporated with a capital stock of $300,000 for the purpose of constructing an electric railway connecting Anderson, Greenville and Spartansburg. It is believed that the railway will be ultimately extended north through North Carolina to Charlotte, Salisbury and Greenville. Electricity for operating the road will be secured from the Southern Power Company, of Charlotte, N. C. The system is to be built

by the Duke interests with other capitalists, including Captain Ellison A. Smythe, Lewis W. Parker and others.

KINGSTREE, S. C.—The Kingstree Electric Company has been granted a charter with a capital stock of $10,000 for the purpose of furnishing electricity for lamps and motors. The officers of the company are: H. C. Case, president; M. V. B. Sickel, vice-president, and S. C. Case, secretary and treasurer.

TISCH MILLS, WIS.—The County Line Telephone Company has been organized to construct about 20 miles of telephone line.

Personal.

MR. CHARLES KIRCHHOFF will be the guest of honor at a luncheon to be given at the Engineers Club on Jan. 16, prior to sailing on a West Indian cruise.

MR. W. H. ZIMMERMAN announces the incorporation of the W. H. Zimmerman Company to do general engineering, with offices in Chicago and a branch in Lansing, Mich.

MR. C. W. NOYES has resigned as secretary of the Willimantic (Mass.) Gas & Electric Company to accept a position on the New England sales staff of the Westinghouse Electric & Manufacturing Company.

MR. JOHN E. HARRILL, superintendent of the Virginia Railway & Power Company, was the recipient on the occasion of the Christmas holidays of a handsome set of cut glass presented to him by employees of the company.

MR. PAUL J. MacCUTCHEON has resigned his position as manager of the New York office of the M. B. Foster Electric Company, electrical engineers and contractors of New York and Boston. Mr. MacCutcheon has not announced any plans for the future.

PROF. R. H. MEYER, of the University of Wisconsin and chairman of the Wisconsin Public Service Commission, has been appointed by the Interstate Commerce Commission a mediator in connection with a controversy between the Illinois Central Railroad and its telegraphers.

MR. F. F. PRENTISS resigned from the presidency of the Cleveland Twist Drill Company on Jan. 4 owing to ill health, and Mr. J. D. Cox was elected to that office. Mr. Cox, who was the founder of the business, has always been the practical man of the concern.

MR. T. P. PINCKARD, formerly general salesman in the Kansas City office of the Westinghouse Electric & Manufacturing Company, has resigned that position, and since Jan. 1 has been connected with the new-business department of the Peoria Gas & Electric Company, of Peoria, Ill.

MR. A. S. COOK, formerly of New York, has been appointed manager of the Citizens' Gas Company, by the syndicate which owns this and many other plants. Mr. Cook will succeed E. A. Wakeman, who has been promoted to be superintendent of a number of plants controlled by the syndicate.

MR. EDWARD J. JEEP, who has managed the advertising department of the Wesco Supply Company for the past 2½ years, has resigned his position and will in the future be connected with the Classified Ad Company, of St. Louis, in the capacity of business manager. His successor will be Mr. R. C. Mellor, who has been with the company for a long time.

MR. J. V. ZARTMAN, of Indianapolis, has been appointed secretary of the Indiana Electric Light Association, succeeding the late Fred Leslie, of Muncie, Ind. Mr. Zartman makes his headquarters in Indianapolis, which is a central point for all members, and where it is easy for him to confer with Mr. C. C. Perry, the president of the association.

MR. JAMES WOLFF, Chicago manager of the New York Insulated Wire Company, has been made chairman of subdivision No. 31 of the new ways and means committee of the Chicago Association of Commerce. This subdivision represents electrical goods, fixtures and wire, and the other members are Mr. James J. Heaney, of E. Baggot Company, and Mr. F. A. Ketcham, of the Western Electric Company.

MR. C. S. BAGG, assistant secretary-treasurer of the Montreal Light, Heat & Power Company, has been appointed purchasing agent and storekeeper in place of the late Mr. A. H. Edwards. Mr. G. Chagnon, general cashier, has been promoted to Mr. Bagg's former position of assistant secretary-treasurer. No successor to the late managing director, Mr. W. McLea Walbank, will be appointed for some time.

PROF. CHARLES R. CROSS, of the department of physics of the Massachusetts Institute of Technology, will deliver a lecture before the Society of Arts, of the Institute, on "The Experimental Evidence for Modern Views as to the Nature of Electricity" on Jan. 26. The lecture will be fully illustrated by experiments showing the principal phenomena of the electrical discharge in vacuo and of radioactivity.

MR. MORTIMER FREUND has resigned from the service of the Navy Department and joined the engineering staff of Mr. Percival R. Moses, consulting engineer, of New York City. Mr. Freund is a graduate of the School of Engineering of Columbia University and has been acting for the past few years as electrical aide to the consulting engineer and inspector of public works, United States Navy Yard, New York.

MR. C. H. STENGEL has resigned as superintendent of coal terminals for the Virginian Railway Company to accept the presidency of the Electrical Alloy Company, Morristown, N. J. Mr. Stengel was in charge of the coal piers at Sewall's Point, Norfolk, Va., since they were completed, and prior to that time was designing engineer for the Virginian Railway Company, for which he designed the above-mentioned piers.

MR. THEODORE I. JONES, general sales agent of the Edison Electric Illuminating Company, of Brooklyn, N. Y., has been engaged by the Department of Education of the City of New York to deliver a course of lectures at the Young Men's Institute on popular electrical subjects. The lectures, which will be illustrated by experiments and stereopticon views, will be devoted to a discussion of the principles and methods of operation underlying various phases of electrical work, descriptions of methods of manufacture and the advantages and disadvantages of different types of apparatus.

MR. B. E. SUNNY, president of the Chicago Telephone Company, contributed an interesting article to the New Year's issue of the Chicago *Record-Herald*, reviewing the progress of electrical development in Chicago during the year 1909. Mr. Sunny spoke of the year as one of exceptional activity and directed attention to the fact that the Commonwealth Edison Company closed the year with a 30 per cent increase in connected load, a 47 per cent increase in the sale of merchandise, a 31 per cent increase in the quantity of electricity produced, and a 30 per cent increase in the number of customers. The Chicago Telephone Company showed an increase of 35,500 telephone units, as compared with an increase of 28,500 for the year 1908. The expenditures of this company for additions to plant amounted to about $4,000,000.

MR. HENRY C. EDDY, until recently engaged in the sale of investment securities in Chicago, has been elected a director of the Northern Heating & Electric Company, of St. Paul, Minn., and also secretary and general manager of that company, which is engaged in a district-heating and central-station business in St. Paul. For a number of years Mr. Eddy was district manager in Chicago for the American District Steam Company, and while in that position designed the heating system of the Northern company, with which he is therefore thoroughly familiar. Further, Mr. Eddy was a close friend of the late Mr. L. L. C. Brooks, the former secretary and general manager of the company, and has kept himself well informed as to the development of the property. Mr. Eddy began his electrical experience with the old Sprague Electric Railway & Motor Company and later was for some time connected with the Western Electric Company. Subsequently he was associated with Mr. J. H. Cooke in the Chicago office of the Buckeye and Jandus Electric companies. His connection with the American District Steam Company followed. Mr. Eddy has long been a student of central-station problems and has a wide acquaintance among electrical men in the West.

Obituary.

MR. P. S. TIRRELL, of Groveton, N. H., who until recently was superintendent and chief electrician of the Corry, Deavitt & Frost Electric Company's electric plant in Montpelier, Vt., died Dec. 30 of cancer of the stomach. Mr. Tirrell was one of the inventors of the Tirrell voltage regulator. He was for a number of years connected with the Lyman Falls Power Company, located near Groveton, N. H. Mr. Tirrell was about 45 years of age and leaves a widow and two children.

MR. GEORGE FRANCIS BROWN, formerly treasurer of the Pullman Company, died at the Calumet Club, Chicago, on Jan. 9, aged 66 years. Mr. Brown had been in ailing health for some time, and his death was not unexpected. His son, Mr. Charles Edward Brown, secretary of the Central Electric Company, Chicago, was at his bedside when he died. Mr. Brown was connected with railroading nearly all of his business life, and from 1871 to 1907 was in the service of the Pullman Company. He was a native of Chicago and a veteran of the Civil War.

MR. CHARLES BATCHELOR.—We regret to note the death of Mr. Charles Batchelor in this city at the age of 64. This pioneer electrical inventor was an associate for many years with Mr. Edison, and received a percentage of the old Edison Laboratory profits—in fact, the sum is said to have reached not less than $750,000. In all of Edison's earlier work Mr. Batchelor had a large share, not perhaps in a creative way but as a most skillful experimenter and executant of the ideas of his fertile chief. To his marvelous manipulative skill and persevering patience were due in part the quick realization in practice of the phonograph, the carbon transmitter and the incandescent lamp, especially the latter, his toil over which is part of the real history of electrical advance. Mr. Batchelor was very proud of his record in this respect, though a man of great reticence. He was an Englishman by birth and came to this country to assist in setting up textile machinery. His early acquaintance with Edison took him at once into the electrical field, for he was just the kind of indefatigable companion wanted; and there resulted what was essentially a partnership which lasted several years. There is a curious absence of Mr. Batchelor's name from the lists of American patents, but this is due to the fact that he was always more than busy trying out the ceaseless suggestions and ideas of Edison. With the acquisition of the Edison business by the General Electric Company, Mr. Batchelor transferred his energy and his fortune to other mechanical industries, in which he remained more or less engaged almost up to the time of his death. The funeral exercises last week were attended by Mr. Edison and by many early Edison associates, including Messrs. Samuel Insull and E. H. Johnson.

MR. DARIUS OGDEN MILLS, president and director of the Niagara Falls Power Company, the Niagara Development Company and the Niagara Junction Railway Company, died at his winter home at Milldrae,

in San Mateo County, California, on Jan. 3. Mr. Mills was born in North Salem, Westchester County, N. Y., on Sept. 25, 1825. His business career was started as a clerk, six years being spent in mercantile work. Later he entered upon the banking business and made much money by financing mercantile ventures among the Western mines, in which also he became interested. In addition to the companies mentioned above, Mr. Mills was president and director of the Erie Elevator Company, New York Botanical Garden, North American Commercial Company and Virginia & Truckee Railroad, trustee of the Provident Loan Society, of New York, and of the United States Trust Company; director of the Atlantic Coast Steamship Company, Bank of New York, Champlain Realty Company, Bellingham Bay & British Columbia Railroad, City & Suburban Homes Company, Farmers Loan & Trust, International Paper, Inyo Development, Lackawanna Steel, Lake Shore & Michigan Southern, Long Dock Mills & Elevator, Madison Square Garden, Mergenthaler Linotype, Metropolitan Museum of Art, Metropolitan Opera & Real Estate, Metropolitan Trust, Mohawk & Malone Railroad, Morton Trust, New York & Putnam, New York Central, North Atlantic Steamship, Erie Railroad and St. Maurice Lumber Company. His philanthropic interests were devoted to helping those who help themselves. He built the Mills hotels, some model tenements, and founded the Training School for Male Nurses. He was interested in art, science, especially astronomy, and education. He was trustee of the Lick Estate and Lick Observatory and did much for the University of California.

Trade Publications.

DYNAMO BRUSHES for all types of commutating machines are described and listed in folders issued by the Ohio Electric Specialty Manufacturing Company, Troy, N. Y.

LIGHTNING PROTECTION.—Folder No. 1077 of the Western Electric Company, 463 West Street, New York, deals with the carbon-block type of protector for use with telephone circuits.

BRIDGING TELEPHONES of the three-bar type, which are said to cost no more than the series-type telephones for party-line service, are described in booklet No. 1080 of the Western Electric Company, 463 West Street, New York.

GAS CALORIMETER.—The Sargent Steam Meter Company, 271 Madison Street, Chicago, has issued an illustrated booklet devoted to automatic gas calorimeters for determining the calorific value, dust, tar, moisture and solid matter in commercial and inflammable gases.

SELECTOR FOR TELEPHONE TRAIN DESPATCHING.—The Western Electric Company has issued a folder showing the manner in which the Gill selector is used in connection with the telephone for train despatching. The device is light and compact, requires very little energy for its operation and is connected directly to the line, eliminating all relays and contacts.

RAMBLER AUTOMOBILE.—The catalog of the "New Rambler" automobile, just issued by Thomas B. Jeffery & Company, Kenosha, Wis., contains among other striking illustrations a beautiful color frontispiece of the new Rambler "Fifty-Five," the leader of the Rambler line for 1910. The new Rambler is built in what is now considered to be the largest automobile factory in the world. Every part of this car is made in this plant, which has been in operation every single working day for nearly 10 years. The new Ramblers are said to be superior in point of quality have succeeded to the business of Thos. B. Whitted & Company as contracting engineers.

BUSINESS NOTES.

WHITTED & WHITE, INC., 1000 Realty Building, Charlotte N. C., have succeeded to the business of Thos. B. Whitted & Company as contracting engineers.

THE LE VALLEY VITAE CARBON BRUSH COMPANY, New York, recently moved into its new factory at 4123 Park Avenue, New York. The company's rapidly increasing business made necessary a large increase of manufacturing facilities. It had outgrown its old plant on Tremont Avenue and was compelled to seek larger quarters.

THE BROOKS ELECTRIC COMPANY, electrical contractors and supply dealers, has opened an elaborate establishment in Baltimore, Md. The store is located on North Eutaw Street, right in the heart of the business district. Mr. Brooks, the proprietor of the new house, is well known in local business circles. He was employed with the Viaduct Telephone Company for many years and was more recently with the electrical contracting firm of Eugene Rosenfeld & Company, who took over the affairs of the Viaduct people.

WATSON-STILLMAN SALES DEPARTMENT.—The Watson-Stillman Company has made several additions to its sales department to handle the increasing business in hydraulic tools and turbine pumps. Edwin Stillman has entered the sales department and is assisting in taking care of customers in New York State, while all Southern railroad business is now in charge of Frank C. Clark. The more direct representation that has become necessary in the Orient will be in the hands of F. W. Horn, the well-known machinery importer of Yokohama, Japan.

THE UNITED STATES VACUUM CLEANER COMPANY has purchased the entire business of the Sterling Vacuum Cleaner Company, and from this time on the business will be transacted by the United States Vacuum Cleaner Company, of Bradford, Pa. The general sales office for Eastern territory will be located at corner of Fifth Avenue and Twenty-third Street, New York City, and will be under the management of Mr. E. M. Houghtaling, general sales manager, New York. The general offices will be located in Bradford, Pa., and the general business of the company will be handled there, including the Western sales business.

AUTOMOBILES IN SMALL TOWNS.—Figures just compiled for the State of Minnesota show that there are in use in that State 6282 automobiles, a very large number of which have been purchased by residents of small towns. The compilation shows that in towns of under 1000 population there are in use 1169 automobiles, while in towns between 10,000 and 21,000 population there are only 252 automobiles. Among the best-known cars the new Rambler leads all those within $1,000 of its price in towns under 1000 population, as well as in towns under 3000 and 5000 population. In explanation of this superiority in numbers, Thomas B. Jeffery & Company have announced that an agricultural implement house in Minneapolis sold in two months prior to Sept. 1, 1909, 200 Ramblers in that territory.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 4, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

945,011. ELECTRICAL SWITCH; W. T. Arndt, Shreveport, La. App. filed July 11, 1908. For lamp sockets whereby the current may be fed to one of two sockets or to both sockets or cut off by means of a rotatable ratchet wheel containing conducting and insulating blades.

945,017. FUSE BOX; R. C. Cole, West Hartford, Conn. App. filed April 29, 1907. A fuse box having a base with line terminals to hold the ends of a cartridge fuse, a hinged cover carrying self-adjusting fuse engaging forks with means operable from the outside of the box for removably locking the fuse in engagement with the forks.

945,018. ELECTROMAGNET; L. Connell, Jr., Portland, Ore. App. filed July 2, 1906. A magnet for vibrating an armature in either of two directions by increasing the current strength without changing the direction. One magnet member has a small core and a high winding and the other a large core and a low winding. The magnetic strength of one or the other predominates as the amplitude of the current varies.

945,023. TELEPHONE TRANSMITTER; S. A. Duvall, South Bend, Ind. App. filed Sept. 26, 1906. Granular carbon transmitter with diaphragm, bridge carrying a carbon cup, a rear and front electrode, a mica disk closing the cup.

945,024. APPARATUS FOR RECOVERING MATERIAL FROM SCRAP IRON; S. W. Egbert, Joliet, Ill. App. filed March 29, 1909. An endless conveyer which passes the scrap through an electrolyte where the material is decomposed and connected on the cathode by an electric current and the waste discharged on another conveyer and carried to a washing bath and then made into bundles.

945,027. ELECTRIC LIQUID HEATER; O. H. Fiddes, San Francisco, Cal. App. filed March 6, 1909. A portable heater in which the heating chamber is surrounded by a coil of resistance wire and a reservoir is located above it with the bed pipe leading from the top of the heating chamber to the atmosphere above the top of the reservoir.

945,049. ELECTRICAL RECEPTACLE AND MOUNTING THEREFOR; F. J. Russell, New York, N. Y. App. filed May 2, 1908. For incandescent lamp plugs. Provided with a stop to prevent its passage through the hole in the support, a clamping device, the stop and clamp engaging the opposite sides of the body and clamping it to the support.

945,069. MULTIPLE TELEPHONE TRANSMITTER; F. W. Wood, Newport News, Va. App. filed July 16, 1906. Transmitting apparatus comprising a casing containing a plurality of transmitters, a common, funnel-shaped mouthpiece therefor, the small end of the mouthpiece projecting into the wall of the casing, and the large end embracing the transmitters with a plurality of receivers, and an independent circuit connecting each of the transmitters with one of the receivers.

945,082. RESISTANCE-GRID; Herbert W. Cheney, Milwaukee, Wis. App. filed June 24, 1909. Has forked end turn portions and a reinforcing member located therein and insulated from the conductor.

945,092. RESISTANCE GRID; B. Haskins, Milwaukee, Wis. App. filed May 20, 1909. A zig-zag conductor and a reinforcing member passing around the grid and insulated therefrom.

945,093. MOTOR CONTROLLER; C. T. Henderson, Milwaukee, Wis. App. filed April 23, 1909. A starting resistance is controlled by a plurality of switches, each provided with a throttling device for preventing closing thereof on excess current. The winding of the throttling device is connected in parallel to the predetermined amount of resistance.

945,103. MOTOR CONTROL SYSTEM; C. E. Lord, Norwood, Ohio. App. filed March 30, 1907. For rolling mills and hoisting machinery. The load is kept constant without the use of a fly wheel. A plurality of dynamos are mechanically connected to the motor and a

storage battery is used with dynamo automatic means for throwing in the battery. On one the load decreases and on another when the load is heavy.

945,116. RESISTANCE GRID; N. Wilkinson, Milwaukee, Wis. App. filed May 20, 1909. A conductor with end turns having slots and insulating members occupying the slots for reinforcing the grid.

945,132. ELECTROLYTIC APPARATUS; J. H. Monge and C. Arzano, St. Gilles-Lez-Bruxelles, Belgium. App. filed Aug. 27, 1907. For plating mirrors with a coating of copper by means of an open-work frame covered with copper blades, with means for lifting it into and out of the bath, without disconnecting it from the circuit.

945,186. SECONDARY BATTERY; W. Morrison, Chicago, Ill. App. filed June 8, 1903. A reversible electric battery containing an alkaline solution and a horizontal positive zinc electrode at the bottom of the cell, a horizontal negative element above it and a separator including partitions between them.

945,212. INSULATOR CLAMP; J. Blackburn, Kirkwood, Mo. App. filed Dec. 3, 1908. An inverted U-shaped body with a shank to receive the insulator with means for engaging the lower ends and locking them on a cross arm.

945,213. INSULATOR CLAMP; J. Blackburn, Kirkwood, Mo. App. filed Jan. 9, 1909. A pin carrying an integral plate bearing on the top of the cross arm with clamping members engaging the sides of the cross arm.

945,243. SECONDARY BATTERY; William Morrison, Chicago, Ill. App. filed June 20, 1902. An electrolyte of alkine zincate, a support coated with a cadmium upon which the zinc is to be deposited.

945,293. LIGHTNING ARRESTER; William C. Shinn, Lincoln, Neb.

945,082.—Resistance Grid.

App. filed Dec. 28, 1908. For telephone systems. An enclosing case of insulating material containing an arrester plate having upturned wings, the cable overlining the plate. Details.

945,311. BOAT WHISTLE; V. Fendrich, Brooklyn, N. Y. App. filed May 18, 1908. The whistle is blown by vapor which is illuminated by a source of light controlled electrically.

945,321. OIL-WELL HEATER; Wm. E. Gardner and Gustav A. Israelson, Pittsburgh, Pa. App. filed April 2, 1909. A sealed metallic chamber insulated, with a pair of spaced electrodes extending therewithin and a pulverized resistance medium between the electrodes.

945,350. INSULATOR; A. B. Tinsley, Ansted, W. Va. App. filed May 11, 1909. Separable sections with aligned apertures and a threaded element mounted therein having a shoulder.

945,365. AUTOMOBILE; C. Berg, Philadelphia, Pa. App. filed March 14, 1908. An electrically driven automobile in which the road wheel has a driving motor on its hub and may be driven in either direction at variable speed.

945,374. ELECTRIC BOND FOR RAILWAYS; H. P. Brown, Montclair, N. J. App. filed April 2, 1907. An angle or splice bar is mounted on the rail and a spiral metallic guard containing a plug of yielding metal of high conductivity is located around a hole in the rail.

945,397. MECHANICAL CONSTRUCTION FOR STORAGE BATTERY CELLS; P. Kennedy, New York, N. Y. App. filed Oct. 3, 1906. A jar, two series of plates of opposite polarity therein, a narrow strip of insulating material across the upper edges thereof with depending teeth to fit between the plates.

945,398. TRANSMISSION OF POWER FROM A PRIME MOVER TO A LOAD; A. C. King and F. Hamer, Hayes, Eng. App. filed Dec. 19, 1908. A combined clutch and variable speed gear, including a driving motor with dynamos having one part driven by the motor and the other part connected with the driven shaft through a gear train normally inoperative which may be energized to cause the gear train to rotate the driven shaft.

945,400. CONTACT SHOE FOR THIRD RAILS; F. Lacroix, Brooklyn, N. Y. App. filed March 31, 1908. Movable mechanism normally holds the contact shoe in an elevated position and a magnet thereon actuates it to depress the shoe.

945,408. MAGNETIC SEPARATOR; S. Norton, Mineville, N. Y. App. filed Aug. 1, 1907. A drum with magnets located therein and a movable conveyor leading obliquely over the drum with magnets underneath the conveyor.

945,425. DYNAMO ELECTRIC MACHINE; E. M. Tingley, Pittsburgh, Pa. App. filed Nov. 13, 1905. A magnetizable core with embedded winding, flanged coupling sleeves clamped to the ends of the core with shaft sections seated in the sleeves and blocks between the sections and the core.

945,429. AUDIPHONE RECEIVER; C. E. Williams, Boston, Mass. App. filed Jan. 6, 1908. Audiphone receiver like 945,430, but using a diaphragm and electromagnet and a case of magnetic material extending integrally across the back of the receiver, insulated from the diaphragm and constituting the permanent magnet of the instrument.

945,430. PORTABLE AUDIPHONE TRANSMITTER; C. E. Williams, Boston, Mass. App. filed Jan. 6, 1908. For deaf persons to be hung on the clothes of the users, including a case, a diaphragm, a co-operating electrode and circuit, resistances rotatable within the case, and contacts for cutting the resistance in series with the circuits.

945,440. SYSTEM OF DIRECTED RECEPTION FOR WIRELESS TELEGRAPHY STATIONS; E. Bellini and A. Tosi, Paris, France. App. filed June 16, 1908. Several dirigible aerials in a fixed position, combined with fixed windings inserted in the conducting parts thereof, with a wave detector and a rotary device connected to the detector and influenced by the currents which traverse the fixed windings.

945,480. COMBINATION TELEPHONE INSTRUMENT; A. L. Sohm, Whittier, Cal. App. filed Sept. 4, 1908. A wall set, the transmitter having a flat face with adjustable engaging members, a second switch and a receiver with gripping portions and members supported by the circuit switch.

945,472. CIRCUIT CONTROLLING MECHANISM; C. H. Moores, Oak Park, Ill. App. filed Aug. 13, 1908. For hoisting motors. A carriage, a track contact member, a contact member on the carriage, with means for retarding the latter during the actuation of the carriage and means for projecting it after a given time.

945,475. AERIAL FOR THE TRANSMISSION AND RECEPTION OF ELECTROMAGNET WAVE ENERGY; Richard Pfund, New York, N. Y. App. filed Feb. 10, 1909. A hollow structure poorly conducting with the energizing machinery located in and around its face and an aerial symmetrically supported from the top to earth connections symmetrically arranged around the base.

945,502. ELECTRIC CONDUCTORS FOR RAILWAYS; E. W. Enequist, New York, N. Y. App. filed Oct. 21, 1907. An insulator for conductors such as rails, including a porcelain cup with a spirally corrugated spool secured in a cavity, a porcelain plug threaded into the spool and a stud passing through a bore in the plug and connecting with the conductor.

945,504. METALLIC FILAMENT FOR INCANDESCENT LAMPS; Carl Farkas, New York, N. Y. App. filed Aug. 18, 1908. Produces a highly refractory coating on a fine conductor by decomposing in a vacuum the vapors of a salt of a highly refractory metal in the presence of vapors of pyrogallol.

945,535. ELECTRIC SWITCH; F. E. Hillard, New York, N. Y. App. filed Aug. 21, 1908. An electric switch with a pair of switch blocks each including a threaded shell, a filling of insulation supporting a terminal and a threaded sleeve surrounding the blocks, with means for rotating the sleeve to move the blocks and separate and bring together the terminals.

945,555. PROCESS OF ELECTRIC WELDING; M. Lachman, New York, N. Y. App. filed March 3, 1908. Spot welding by forming in the surface a groove so as to reduce the area at the point of the weld, placing the butt of the tooth to be welded on the surface and passing a current therethrough.

945,564. STORAGE BATTERY; P. M. Marko, New York, N. Y. App. filed June 10, 1909. In the wall of the box there is inserted an electric meter with a push-button switch which is below the wall of the box and protected against acids.

945,586. EMERGENCY VALVE; O. Penn, Pittsburgh, Pa. App. filed Sept. 16, 1909. A gate valve for steam pipes, actuated by a spring and lock by electrically controlled mechanism.

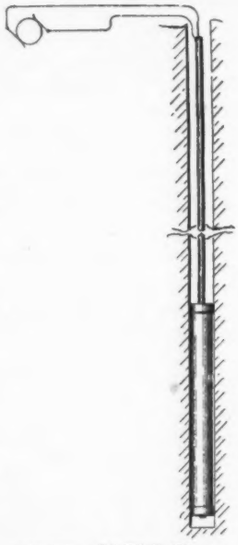
945,594. FUSE; F. P. Poole and H. U. Badeau, Bridgeport, Conn. App. filed May 14, 1909. A perforated fused sheath and an indicator wire passing therethrough, with sealing material filling the perforations throughout which the wire passes and a lining for the perforations.

945,614. BATTERY ELECTRODE SUPPORT; C. B. Schoenmehl and W. Straw, Waterbury, Conn. App. filed April 9, 1909. An electrode supports the batteries, including a cross yoke with downwardly arranged ends, a hanger engaging the edges of the electrode and having eyes to engage the ends of the yoke.

945,618. MULTIPLE LAMP SOCKETS; F. E. Seeley, Bridgeport, Conn. App. filed May 9, 1908. A lamp cluster with a metallic back plate carrying insulating blocks and terminals plate, binding screws and contacts and a canopy carrying lamp holders.

945,634. SWITCH MECHANISM FOR ELECTRICAL ALARM APPARATUS; A. V. Strait, Sidney, N. Y. App. filed Feb. 27, 1909. An electric call clock which automatically actuates a bell at the desired time to call the guests in a hotel. A metallic circuit-closing tag has an opening which receives the supporting terminal, the upper margin of the tag constituting an electrical connection. The tag is placed in the switchboard by the clerk and is thrown into circuit by the clock at the desired time.

945,660. ELECTRICAL TROLLEY DEVICE; L. G. Wilson, Larchmont, N. Y. App. filed May 23, 1908. For permitting an overhead trolley to pass through opening protected by screens without interrupting the current supply. The trolley conductor is terminated on each side of the screen and each of its terminals are attached to a fixture mechanically and electrically connected to the trolley wire on which the wheel rides. A movable switch is attached to the fixture which bridges the gap.



945,321.—Oil-Well Heater.

945,475.—Aerial for the Transmission and Reception of Electromagnetic Wave Energy.

945,671. OIL SWITCH; H. P. Ball, New York, N. Y. App. filed Jan. 19, 1905. Comprises two annular guides and a contact ring consisting of a number of laterally yielding contacts between the guides and annular channels in the ring engaged by the guides.

945,712. CONICAL PIVOT BEARING; A. F. Fletcher, Cleveland, Ohio. App. filed Nov. 3, 1908. For trolley wheels. Provides a conical bearing which receives a lubricant. Details.

945,716. MOTOR DEVICE FOR ELECTRIC CLOCKS; J. Granz, Chicago, Ill. App. filed Jan. 22, 1909. A spring actuated clock movement controlled by an open battery circuit, including an electromagnet which actuates an armature in one direction, it being controlled by a spring in the other. A tensioning device for the motor spring of the clock movement is also in the battery circuit and actuated by the armature lever.